VOL. 14 JANUARY, 1941 NO. 1

Journal

OF THE

Kansas Entomological Society

PUBLICATION COMMITTEE
PAUL B. LAWSON, Editor, Lawrence
R. H. BEAMER, Lawrence R. H. PAINTER, Manhattan
DWIGHT ISELY, Fayetteville, Ark.

JAMES WALKER McCOLLOCH
1889-1929

Entered as second-class matter June 7, 1939 at the Post Office at Manhattan, Kansas, under the Act of August 24, 1912

Kansas Entomological Society

Volume 14 January, 1941 Number 1

James Walker McColloch

James Walker McColloch, whose likeness appears on the Journal cover, was born at Anthony, Kansas, April 14, 1889. He died November 11, 1929, at Manhattan, Kansas. He was graduated from the Kansas State College in 1912. During his undergraduate work in 1910 and 1911, he was employed by the college as a special field agent, and began his entomological investigations on the chinch bug. Hessian fly and corn earworm. In 1912 he was appointed Assistant Entomologist of the Kansas Agricultural Experiment Station. It was soon discovered that Mr. McColloch was a man of unusual research ability and a good teacher. His bulletins on the chinch bug and Hessian fly, scientific papers on the chinch bug egg parasites, dust sprays for the control of the corn earworm, and the dispersal of the Hessian fly by wind, attracted wide attention and received favorable comment. His ability and usefulness was recognized by the college by promoting him, in 1918, to the position of Associate Professor of Entomology and Associate Entomologist of the Kansas Agricultural Experiment Station. His research was expanded to include studies of soil-inhabiting insects, insect ecology, and the resistance of plants to insect attack. In those studies he soon established for himself an enviable reputation and was regarded by the entomologists as one of the outstanding research men in economic entomology. He received the degree of Master of Science from the Kansas State College in 1923. During the absence of the head of the Department of Entomology of the Kansas State College from 1923-1925, Professor McColloch was acting head of the department, acting entomologist of the Kansas Agricultural Experiment Station, and acting State Entomologist. Here he demonstrated his ability as an executive. In 1925 he was promoted to a full professorship.

Professor McColloch was absolutely trustworthy, dependable and loyal. During the twenty years that he was connected with the Department of Entomology of the Kansas State College, he was always willing to carry more than his share of the work. He possessed the rare ability of quickly analyzing a situation, particularly an insect outbreak, and seldom erred in his judgment. His whole life was one of service and he was most happy when serving others. In spite of his pressing duties in entomological work, he found time to devote considerable attention to his duties in the Masonic Lodge, the Congregational Church, his community, his committee work in

scientific societies, the editorial work of the Kansas Agricultural Experiment Station, the Journal of the Kansas Entomological Society and the Biological Abstracts. Professor McColloch was a member and an active worker in the American Association for the Advancement of Science, American Association of Economic Entomologist, Entomological Society of America, American Microscopical Society, Kansas Entomological Society, Kansas Academy of Science, and Kansas State College Chapters of Sigma Xi, Phi Kappa Phi, Gamma Sigma Delta, and Alpha Zeta.

Professor McColloch's earnest desire for economic entomology to develop on that broad and constructive plane so necessary for the rendering of the maximum service and usefulness was well illustrated by his leading part in the inauguration and the participation in meetings of entomologists, such as the North Central States Entomologists, Rocky Mountain Conference of Entomologists, and the Kansas Entomological Society, engaged in similar entomological problems.

The fine generosity and vision of professional service of Professor McColloch were largely instrumental in determining the practice of free exchange of plans of investigations and unpublished information on entomological investigations conducted by workers interested in Hessian fly, chinch bug, corn earworm, white grubs, and other staple crop insects.

In his untimely death, entomology suffered an incalculable loss, and his associates and co-workers in the United States, Canada and many foreign countries felt intimately the loss of his fine personality, fellowship and stimulating influence.

—GEO. A. DEAN

NOTICE

The seventeenth annual meeting of the Kansas Entomological Society is to be held at the Kansas State College, Manhattan, Kans., on April 5, 1941. Titles for papers to be presented at that meeting should be sent before March 1, 1941, to the secretary, Mr. D. A. Wilbur, Dept. of Ent., K. S. C., Manhattan. Please specify the time to be allowed for the presentation of the paper and indicate whether a lantern is to be used.

R. L. PARKER, President

SOME RECENT WORKS ON THE CLASSIFICATION OF IMMATURE INSECTS[1]

Wm. P. Hayes, Urbana, Illinois

With the recent publication of two rather comprehensive keys to the orders of immature insects by Peterson (1939) and by Metcalf and Flint (1939) has come the thought that it would be well to bring together references and make some comment on other recent papers of this kind that will aid the student in finding keys for the identification of the various developmental stages of insects. There have been published a number of useful keys to immature stages in recent years. Some of these are in obscure periodicals and are easily overlooked by the average entomologist. Hence a bringing together of the more important of these citations should prove of value.

The study of the taxonomy of immature stages has never and probably never will keep pace with that of adult forms because of the immensity of the task of discovering and associating properly the young and the imago of the enormous number of species now known only in the adult stage. We shall always be confronted with the problem of identifying larvae, pupae, nymphs and even eggs and when an unknown immature is before us, unless it is a familiar species, we can resort to the tedious process of rearing it to adulthood and identifying it from adult keys, or else make use of our available keys to the comparatively few known developing stages. To anyone who has worked with keys of this nature, it is well known that they are notable for their incompleteness, are often difficult to use and chances are that, more often than not, the user may have for identification a specimen that has not been seen or studied and not therefore included in the key. A further difficulty is evidenced by the fact that the more our knowledge grows of these immature forms the more necessary it is going to become to construct a key for every instar which the immature stages pass through. A few keys of his nature are in existence and are of two kinds, those such as Riley and Johannsen (1932) have given us to all instars of the cyclorrhaphous Diptera of medical importance and others that are keys to the various instars of a given species. Notable among the latter is a key to the instars of **Melanoplus mexicanus** by Shotwell (1930) and those of Nevin (1929a and 1929b) to the instars of certain species of the odonate genera **Agrion** and **Sympetrum**. Such studies as these indicate that eventually it may be necessary in many groups to construct instar keys for the various species as they become known before we can

[1]Contribution No. 211, Department of Entomology, University of Illinois.

have a completely comprehensive key to the group in question. Hence in life history studies, it should be part of any thorough work the making known of all developmental changes as they occur from instar to instar. Such knowledge is especially important in orders like Lepidoptera where there are changes of coloration, ornamentation and setal patterns from instar to instar.

Classwork in the taxonomy of immature insects is now being offered to students at a number of institutions and it is being realized, more and more, the necessity of more and better studies in the field. With the hope that other investigators will become interested in such studies and to point out to others who have not followed the literature of this kind the following is offered to indicate some, but not all, of the considerable number of new papers in the field. It is not intended to be a complete bibliography and only comparatively recent papers have been noted. These are accompanied by some comment on a few little known older keys.

General Keys to Orders:—Our immature keys to orders may be said to be of two kinds—those of a general nature, including either all the orders or all those orders having complete metamorphosis and excluding those with gradual metamorphosis and those, of which there are many, that include the orders that are aquatic. Our two most recent keys, as mentioned above, by Peterson (1939) and Metcalf and Flint (1939) are of the more general type and include keys to orders of pupae. Strangely enough, both these keys are based on an unpublished key by A. D. MacGillivray which he used in his classes at the University of Illinois before his death. The two published versions of this key are quite useful but not without faults. A general key that is little known is an earlier work by Allee and Shelford (1923) in which are keys to nymphs, larvae and pupae of the freshwater and terrestrial orders of the "moist temperate region of North America." The University of Chicago Press has just (Dec. 1939) announced the publication of a revised and extended edition of this work entitled "A laboratory introduction to animal ecology and taxonomy," under the authorship of Park, Allee and Shelford. Chrystal (1937) in an English book entitled "Insects of the British Woodlands" has produced a general key to the principal types of insect larvae. It is based, in part, on food habits or so-called "biological types" and excludes specialized forms such as leaf-miner and unusual dipterous types.

A number of works exist which contain keys to aquatic insect orders. A recent one it that of P. R. Needham (1938) in a book entitled "Trout Streams" in which nymphs and larvae of aquatic orders are distinguished. Karny's (1934) German work on "Biologie die Wasserinsekten," (biology of water insects) is one that contains general keys as well as keys to several aquatic orders. An unpublish-

ed key to orders has been produced by the workers of the U. S. National Museum which is quite useful.

Smaller Orders:—Among the smaller orders of insects with gradual metamorphosis the only noteworthy recent taxonomic works have been with the aquatic nymphs (naiads) of the orders Plecoptera, Odonata and Ephemeroptera. The nymphs of Plecoptera have been studied taxonomically by Claassen (1931) and Frison (1929, 1935 and 1937). Of these the work of Claassen covers the more extensive North American fauna while Frison's studies are limited to the fauna of the state of Illinois.

In the Ephemeroptera the monographic work of Needham, Traver and Tsu (1935) is our most extensive North American study on the Mayflies. This volume not only distinguishes the nymphs but also contains a key to the known eggs of the order. Traver (1932-1933) has published keys to the nymphs of the species occurring in North Carolina and in other papers has produced keys to species of the genus **Hexagenia** (1931) and to genera of the **Heptagenine** Mayflies (1933). The species of **Leptophlebia** have been keyed by Gordon (1933).

For the Odonata, Needham and Heywood's "Handbook of the Dragonflies of North America" published in 1929 remains the comprehensive work treating of immature stages. Only smaller articles have appeared since. Some of these are works of Walker (1933) on the Canadian species of **Ophiogomphus** and Byer's (1936) key to the genera of Corduliinae and Libellulinae. A somewhat earlier but still quite usable set of nymphal keys is in Garman's (1927) Odonata of Connecticut. In Europe, Schmidt (1936) has keyed the nymphs of **Leucorrhinia.**

Hemiptera:—Most nymphal keys to this order are concerned with the aquatic species. A recent key to the fourth and fifth instar nymphs of European species of **Gerris** is that of Mitis (1937).

Neuroptera:—Townsend (1935) has given us a key to the families and in some instances subfamilies of the Neuroptera. Two notable volumes on this order are those of Killington (1936-37). This work deal with the immature stages of **Plannipennia** and gives a key to larval families found in Great Britain.

Trichoptera:—Betten (1934) has a family key to this order and Milne (1939) has given us another key to the larval families.

Lepidoptera:—Our standard general keys for the identification of larval Lepidoptera are the older works of Fracker (1915) and Forbes (1923). These are keys to families. A number of keys to genera and species of various families exist. A new family key has been published by Gerasimov (1937a) in the German language. This

key has been translated into English and will be used by the writer's students in identifying immature insects this coming semester. Gerasimov appears to be the only active worker who is publishing regularly on larval forms of this order. Three of his recent papers (1937b, 1937c and 1937d) discuss and key the larvae of Psychidae, Hepialidae and of the genera **Stigmella (Nepticula)** and **Tischeria.** Comparatively recent American studies on cutworms (Noctuidae) have been those of Crumb (1929 and 1934) and Whelan (1935). A key to European species of the genus **Notodonta** has just been published by Hanson (1939) and one to four species of **Agrotis** by Fiedler (1937).

Coleoptera:—The monumental work of Böving and Craighead (1930) on the larvae of North American Coleoptera will be a standard for years to come. It is a general work which keys beetle larvae to families and in some cases subfamilies. This comprehensive study of the higher groups has apparently been a stimulus to others for we have more new works appearing that deal with the lower categories of beetle larvae than any other order. Other general works cannot be overlooked: the old family key of MacGillivary (1903) has been republished and somewhat revised by Balfour-Browne (1932). This simplified key treats only of the common families. A more extensive key to families is that of Rymer-Roberts (1930). Both the works of Böving and Craighead and of Rymer-Roberts consider details of structure particularly of the mouthparts and their keys are difficult for the novice to use. A fairly recent key to families, and one that has been overlooked is that of Blair (1934) which is rather extensive in scope, but based, in great part, on habits rather than structure.

Papers covering more restricted groups of beetle larvae have been numerous lately. A number of European keys that are not generally known are those of Guignot (1931-33), Karny (1934) and Bertrand (1928) which are extensive works on aquatic families; Butovitch and Lehner (1933) have keyed the coleopterous larvae of the soil in pine forests; Saalas (1923) has a more general account of beetle-larvae in pine forests of Finland; Van Emden (1938) an extensive work to certain groups of curculionid larvae and Rymer-Roberts (1939) has treated the larval Eryotilidae. Henning (1938) has produced keys to subfamilies, genera and species of the most important German Chrysomelidae. A little known key to the subfamilies of the larvae and pupae of Chrysomelidae is that of Patterson (1931). Two recent American keys to species of certain genera of Staphylinidae are those of Voris (1939a and 1939b). Ritcher (1938 and 1940) has published keys to larvae of the scarabaeid genus **Phyllophaga** found in Kentucky and at present Dr. Böving is at work on a more inclusive key to this genus of white grubs which we hope will be published soon. Böving and Henderson (1938) have recently issued an extensive work on larval Hydrophilidae of Denmark. The

writer recently translated an earlier German work on carabid larvae by Von Emden and had been planning to make the translation available to American students but after looking over the translation and the available specimens, Dr. Van Emden has taken up the task of revising this key and it is hoped that it will soon appear and in all probabilty will be published in English.

Hymenoptera:—This order has been neglected as far as general keys to families are concerned. The only work of such a nature is that of Brues and Melander (1932) which is based, in part, on the earlier work of Yuasa (1922) on the Chalogastra and on the habits rather than structures of the common families of Clistogastra. Only a few recent keys to divisions of this order have appeared. One pertaining to the genera of two parasitic families is a not generally known work by Bakkendorf (1934) that which treats the families of Mymaridae and Trichogrammidae. Another is Ritcher's (1933) key to larval bumblebees. Cameron (1938) working in England, studied the parasites of the pea moth and worked out keys to the primary larvae, mature larvae and cocoons of several parasitic genera. He has also done the same (1939) for the parasites of the Holly Leafminer except that there are keys for the pupae instead of cocoons.

Diptera:—The writer has recently (Hayes, 1938-39) published a bibliography of works in this order that contains keys to the immature forms. Some overlooked citations to older papers were not included in this list. These have been called to my attention by a few correspondents. Most are obscure works on mosquitoes. It is hoped that these, with the addition of a few more recent papers, can be brought together in the form of a supplement to the original list. Some of the recent papers not included in the list of this order are here cited. Leeson (1939) has given us a recent fourth instar key to West African mosquitoes. Wells and Knipling (1938) have second and third keys to species of bots in horses. Thienemann (1939) has larval and pupal keys to the genus **Psectrocladius** and other recent papers on the chironomid group and DeMeijere (1938) a larval key to species of Agromyzidae inhabiting vetch (**Vicia**). Evans (1938) has a key to larval Anopheline mosquitoes of Ethiopia; Carpenter (1939) has published keys to the larval mosquitoes of Arkansas, while Owen (1937) has a key to those of Minnesota.

Perhaps the most important recent works with keys to immature American Diptera cited in the bibliography referred to above are the series of papers by Johannsen (1934, 1935, 1937) on aquatic Diptera and those in Riley and Johannsen's (1932) text book, "Medical Entomology" that distinguish larval Diptera of medical importance. The classic in this order is the early work of Malloch (1927) which now needs revision and whose second part has never been published that

was to have dealt with the Cyclorrhapha. This group is of great importance as larvae and one that has never been thoroughly treated from the taxonomic standpoint. Most of the available works in this division of the Diptera pertain to those groups of medical importance. Large families such as the Tachinidae and Anthomyiidae and others present fertile fields for research.

REFERENCES CITED

Allee, W. C. and Shelford, V. E.
1923 Synoptic key to phyla, classes, and orders of animals with particular reference to fresh water and terrestrial forms in moist regions of North America University of Chicago Press. 63 pp.

Bakkendorf, F.
1934. Biological investigations on some Danish hymenopterous egg parasites, especially homopterous and heteropterous eggs, etc. Ent Meddeleser 19: 1-134.

Balfour-Browne, F.
1932 A text-book of practical entomology. Longmans, Green and Co., N. Y., and Arnold and Co., London, 191 pp

Bertrand, H.
1928. Les larves et nymphes des Dytiscides, Hygrobiides et Haliplides. Ency Entom. Vol 10. 368 pp.

Betten, C.
1934. The caddis-flies or Trichoptera of New York State. N Y. State Mus Bul. 292, pp 1-576.

Blair, K. G.
1934. Beetle larvae Proc. and Trans. So. London Ent and Nat. Hist Soc. for 1933-34 pp. 89-110.

Böving, A. G. and Craighead, F. C.
1930. An illustrated synopsis of the principal larval forms of the order Coleoptera. Ent Amer., 11: 1-351.

Böving, A. G. and Henderson, K. L.
1938. The developmental stages of the Danish Hydrophilidae. Vidensk. Medd fra Dansk. naturh. Foren., Bd. 102. pp. 27-162.

Brues, C. T. and Melander, A. L.
1932 Classification of insects. A key to the known families of insects and other terrestrial arthropods. Bul. Mus. Comp. Zool., Vol. 73, 672 pp.

Butovitch, B. and Lehner W.
1933 Bestimmungstabelle der wichtigsten in märkischen kiefernwaldböden verkommenden insektenlarven. J. Springer, Berlin. 16 pp.

Byers, C. G.
1936. The immature form of **Brachymesia gravida,** with notes on the taxonomy of the group. (Odonata.Libellulidae) Ent. News, 47: 35-37, 60-64

Carpenter, S. J.
1939. The mosquitoes of Arkansas. Arkansas State Board of Health. mimeog 89 pp. 31 figs.

Chrystal, R. N.
1937. Insects of the British Woodlands. Warne and Co. Ltd. London. 338 pp.

Claassen, P. W.
1931. Plecoptera nymphs of North America. Thomas Say Foundation. Thomas Co., Springfield, 199 pp.

Crumb, S. E.

1929. Tobacco cutworms U. S. D. A., Tech. Bul 88, pp. 1-179

——— 1934 A classification of some noctuid larvae of the sub-family Hypeninae. Ent. Amer., 14 (n s) 133-197.

DeMeijere, J. C. H.

1938 Die larven Agromyzinen (Vierter Nachtrag) Tijdschrift voor Ent., 81 61-90

Fielder, H.

1937 Die wichtigsten schadlichen erdraupen der gattung Agrotis Inaug. Diss. Friedrich Wilhelms Univ. Berlin G Feller, Neubrandenburg

Forbes, W. T. M.

1923 The Lepidoptera of New York and neighboring states Cornell Agr Exp Sta., Memoir 68, pp 1 729.

Fracker, S. B.

1915 The classification of lepidopterous larvae Ill Biol Monog 2 1-161

Frison, T. H.

1929 Fall and winter stoneflies, or Plecoptera, of Illinois Ill State Nat. Hist Surv., Bul 18 343-409.

———1935 The stoneflies, or Plecoptera, of Illinois Ill State Nat Hist Surv Bul 20, 281 471

1937 Descriptions of Plecoptera with special reference to Illinois species Ill State Nat Hist Surv Bul 21 78 99

Garman, P.

1927 Guide to the insects of Connecticut. Part V The Odonata or dragonflies of Connecticut Conn Geol and Nat Hist Survey Bul 39 331 pp.

Gerasimov, A. M.

1937a Bestimmungstabelle der familien von schmetterlingsraupen. Stett. Ent Zeit., 98 281-300.

——— 1937b Beitrag zur systematik der Psychiden auf grund der erforschung der raupen (Lepid) Zool Anz., 120. 7-17.

——— 1937c. Zur systematik der raupen von Stigmella Schrank (Nepticula) und Tischeria Z (Lepid) Ent Rundschau, 55 89 91

——— 1937d Hepialiden raupen (Lepid) Ent. Zeit., (Frankfurt) 51 81-84

Gordon, E. L.

1933 Notes on the ephemerid genus Leptophlebia Bul. Brook Ent Soc., 28 119 130

Guignot, F.

1931-33 Les Hydrocanthares de France Hygrobiidae, Haliplidae, Dytiscidae et Gyrinidae de la France Continental Ent Soc. France. Misc Ed., Les Freres Douladoure, Toulouse, 1057 pp

Hayes, W. P.

1938-39 A bibliography of keys for the identification of immature insects, Part I Diptera Ent. News, 49 246-251, 50 5-10 and 76-82

Hanson, B. H.

1939 Die raupen der europäischen arten von Notodonta Ochs (Lep), Entom. Tidskrift, 60 133-142.

Hennig, W.

1938. Ubersicht uber die larven der wichtigsten deutschen Chrysomelinen Arbeit über Phys. und Angew. Entom., 5 85-136.

Johannsen, O. A.

1934. 1935. 1937. Aquatic Diptera Part I, II and III Cornell Univ Agric Exp. Sta., Memoirs 164, pp 1-71; 177, pp. 1-62, and 205, pp. 1-84.

Karny, H. H.

1934 Biologie der Wasserinsekten, F. Wagner, Wien, 31 pp

Killington, F. J.

1936-1937 A monograph of British Neuroptera. Ray Society, London Vol. 1, series 122, 1936 and Vol II, series 123, 1937.

Leeson, H. S.

1939. Keys to the known larvae and adults of West African anopheline mosquitoes. Bul. Ent Res, 30: 129-161.

MacGillivray, A. D.

1903. Aquatic Chrysomelidae and a table of coleopterous larvae N. Y. State Mus, Bul 68 pp. 288-327.

Malloch, J. R.

1927 A preliminary classification of Diptera, exclusive of puparia, based upon larval and pupal characters, with key to imagoes in certain families Part I Bul. Ill State Lab Nat Hist, 12 161-407

Metcalf, C. L. and Flint, W. P.

1939 Destructive and useful insects, 2nd Edition. McGraw-Hill Co, New York 981 pp

Milne, M. J.

1939 Key to North American caddis larvae Psyche 46 11

Mitis, H. von.

1937 Ökologie und larvenentwicklung der Mittel-europaischen Gerris-arten (Heteroptera). Zool Jahrb. (Syst), 69. 337-372

Needham, J. G. and Heywood, H. B.

(1929) A handbook of the dragonflies of North America Thomas Co, Springfield, Ill 378 pp

Needham, J. G., Traver, J. R. and Tsu, Y.

1935 The biology of mayflies with a systematic account of North American species Comstock Publishing Co, Ithaca, N. Y 759 pp

Needham, P. R.

1938 Trout streams, conditions that determine their productivity and suggestions for stream and lake management Comstock Pub Co, Ithaca, N Y. 233 pp.

Nevin, F. R.

1929a. A study of the larva of **Calopteryx (Agrion) maculata.** Trans Amer Ent Soc, 55 425-427.

—— 1929b Larval development of **Sympetrum vincinum** (Odonata Libellulidae) Trans Amer Ent. Soc., 55 79-102.

Owen, W. B.

1937 The mosquitoes of Minnesota, with special reference to their biologies Minn. Agr. Exp Sta., Tech. Bul 126: 1-75

Park, O., Allee, W. C. and Shelford, V. E.

1939 A laboratory guide to animal ecology and taxonomy Univ. Chicago Press, Chicago. 272 pp.

Patterson, N. F.

1931. The bionomics and comparative morphology of the early stages of certain Chrysomelidae (Coleoptera, Phytophaga). Proc. Zool Soc. London 1931, pp. 879-949.

Peterson, A.

1939. Keys to the orders of immature stages (exclusive of eggs and pronymphs) of North American insects Ann Ent. Soc. Amer., 32: 267-278.

Ritcher, P. O.

1933. The external morphology of larval Bremidae and a key to certain species (Hymenoptera) Ann. Ent. Soc. Amer., 26: 53-63

—— 1938. A field key to Kentucky white grubs. Jour Kans. Ent. Soc., 11: 24-27.

——1940. Kentucky White Grubs. Ky. Agr. Exp. Sta., Bul. 401, pp. 73-155.

Riley, W. A. and Johannsen, O. A.
1932 Medical entomology, a survey of insects and allied forms which affect the health of man and animals 1st ed McGraw Hill Co., N. Y. 476 pp.

Rymer-Roberts, A. W.
1930 A key to the principal families of Coleoptera in the larval stage Bul. Ent Research, 21: 57-72.
———1939 On the taxonomy of Erotylidae (Coleoptera) with special reference to morphological characters of the larvae Trans R Ent Soc. Lond., 88 89-118.

Saalas, U.
1923 Die Fichtenkafer Finnland II Specieller Teil 2 und larvenbestimmungstabelle Ann Acad Scient Fennicae, Ser. A Tome XXII No 1 Helsinki 746 pp

Schmidt, E.
1936 Die europaischen Leucorrhinialarven, analytisch betrachtet (Ordnung Odonata) Arch f Naturges neue folge, Band 5 pp 287-295

Shotwell, R. L.
1930. A study of the lesser migatory grasshopper U S D A Tech Bul. 190, 34 pp

Thienemann, A.
1937 Arktische chironomidenlarven und puppen aus dem Zoologischen Museum, Oslo Norsk. Ent. Tidssk., 5: 1-7. 1937

Townsend, L. H.
1935 Key to larvae of certain families and genera of nearctic Neuroptera. Proc Ent Soc Wash., 37 25-30

Traver, J. R.
1931 Some new southern species of the mayfly genus Hexagenia, with notes of the genus Ann Ent Soc Amer., 24 591-619
– 1932 1933 Mayflies of North Carolina, Jour Elisha Mitchell Sci Soc., 47 85-236 and 48 141-206
1933 Heptagine mayflies of North America Jour N Y Ent Soc., 41 105-125

Van Emden, F.
1938 On the taxonomy of Rhynchophora larvae (Coleoptera) Trans R Ent Soc Lond., 87 1 37

Voris, R.
1939a Immature staphylinids of the genus Quedius. (Coleoptera Staphylinidae) Ent News, 50 151 155 and 188-190
– – – 1939b The immature stages of the genera Ontholestes, Creophilus and Staphylinus (Staphylinidae, Coleoptera) Ann. Ent Soc Amer., 32 288-300.

Walker, E. M.
1933 The nymphs of the Canadian species of Ophiogomphus. Can. Ent., 65 217-229

Wells, R. W. and Knipling, E. F.
1938 A report on some recent studies on species of Gasterophilus occurring in horses in the United States Iowa Journ Sci., 12: 181-203

Whelan, D. B.
1935. A key to the Nebraska cutworms and armyworms that attack corn Nebr Agr Exp. Sta., Research Bul 81, pp 1-27.

Yuasa, H.
1922 A classification of the larvae of Tenthredinoidea. Ill Biol Monog., Bul 7, 168 pp.

FIELD INFESTATION OF WHEAT BY INSECTS ATTACKING IT IN FARM STORAGE

R. T. Cotton and T. F. Winburn
Bureau of Entomology and Plant Quarantine

Reports that insect infestation in farm-stored wheat in the Missouri, Mississippi, and Ohio valleys is the most severe in 20 years have caused considerable speculation as to the extent to which this infestation originated in the field before the wheat was harvested. The fact that infestation of grain in the field is common in the southern states and that winters for the past few years have been mild and conducive to the wintering over of stored-grain pests at points farther north than usual gave credence to the supposition that field infestation may be of some importance in this region.

Examination of corn in the field, in the fall of 1938, showed some infestation of the rice weevil (**Sitophilus oryza**) (L)) present in Kansas, Oklahoma, Missouri, and Illinois. This insect is not resistant to low temperatures, and infestations of it in corn, in Kansas and Missouri, that were examined in November were found to have been killed by the cold. The custom of storing the corn in slatted cribs exposed to the cold probably prevents wintering over of the rice weevil in corn in these States.

Field infestation of corn by the Angoumois grain moth **Sitotroga cerealella**) (Oliv.)) also occurred to some extent in Kansas, Missouri, Illinois, and Oklahoma in the fall of 1938 and a certain percentage survived the mild winter following. This infestation increased during the summer of 1939, and caused considerable damage to the unshelled corn in the southern portions of these States.

During May and early in June in 1939, an attempt was made to obtain information regarding the extent of infestation of wheat in the field in Texas, Oklahoma, Kansas and Missouri, by insects classed as pests of stored grain. Quart jars were filled with wheat heads clipped from wheat fields in many parts of the wheat-growing region of these four states. These samples of wheat heads were held for several months for the possible emergence of insects. They were examined in September and October and a record made of all insects found in the jars with the wheat. Data regarding the insects reared from these samples are included in Table 1.

From the date of Table 1 it may be noted that the preponderance of insects reared from the wheat heads were scavengers. These are common in the fields and breed in many types of decaying vegetable matter. The samples were taken when the grain was not quite mature and had a high moisture content. Grain stored in this condition is very favorable for the development of this class of insects. The two most abundant forms, the foreign grain beetle (**Ahasverus**

TABLE 1.—Insects reared from heads of wheat collected in the field before harvest, 1938.

Species	Order	Family	Number of samples infested	Distribution	Remarks
Sitotroga cerealella (Oliv.)	Lepidoptera	Gelechiidae	2	Texas, Mo.	The Angoumois grain moth.
Stilbus apicalis (Melsh.)	Coleoptera	Phalacridae	1	Texas	The larvae of this species live in the heads of flowers.
Carcinops 14-striata (Steph.)	do.	Histeridae	1	Kansas	This insect is predaceous on grain insects and a scavenger. Cospolitian in distribution.
Cryptorhopalum ruficorne Lec.	do.	Dermestidae	1	Texas	Probably a scavenger not previously recorded from grain.
Anthrenus verbasci (L.)	do.	do.	1	Okla.	Mainly a scavenger. Cosmopolitan. Often found in grain, seed, etc.
Trogoderma versicolor (Creutz.)	do.	do.	3	Kansas, Texas, Mo.	A cosmopolitan feeder on grain and grain products.
Trogoderma sp.	do.	do.	5	Mo., Kans., Texas	These specimens may be T. versicolor.
Ahasverus advena (Waltl)	do.	Cucujidae	27	Texas, Kansas, Mo., Okla.	The foreign grain beetle. A very common pest in the field in this region. Abundant on field corn and grain that is out of condition. Cosmopolitan.
Laemophloeus minutus (Oliv.)	do.	do.	1	Kansas	The flat grain beetle is not uncommon in the field in warm climates.

Table 1.—continued.

Species	Order	Family	Number of samples infested	Distribution	Remarks
Cryptophagus sp., possibly **dentatus** Hbst.	Coleoptera	Cryptophagidae	1	Kansas	C. **dentatus** has not been recorded from this country, although recorded from Europe, Madeira, and Japan breeding in granaries in flour and vegetable refuse.
Typhaea stercorea (L.)	do.	Mycetophagidae	20	Kansas Mo., Texas, Okla.	A common pest in the field in this region, with habits similar to those of the foreign grain beetle.
Cartodere argus Reit.	do.	Lathridiidae	1	Texas	Previously recorded from houses and museums breeding in dried vegetable material.
Corticaria serrata (Payk.)	do.	do.	1	Kansas	This species is probably a scavenger and breeds in decaying vegetable matter.
Melanophthalma americana Mann.	do.	do.	2	Okla. Kansas	Breeds in grain out of condition. A scavenger.
Melanophthalma longipennis Lec.	do.	do.	1	Kansas	Breeds in grain out of condition. A scavenger.
Alphitophagus bifasciatus (Say)	do.	Diaperinae	1	Kansas	The two-banded fungus beetle. A cosmopolitan pest of grain that is out of condition.
Brachytarsus sticticus (Boh.)	do.	Anthribidae	1	Mo.	Previously reported from the eastern part of the country, with similar habits.
Sitophilus oryza (L.)	do.	Curculionidae	1	Kansas	At the present time is not common in wheat fields in Kansas.

TABLE 2.—Insects reared from heads of wheat collected in fiield in Missouri and Kansas in 1939

Date of collection	Locality	Date Examined	Species and number	Remarks
			Phalacridae	
June 29	Carrolton, Mo.	Sept. 20	**Stilbus apicalis** (Melsh.) (1)	The larvae of the Phalacridae live principally in the heads of flowers.
June 27	Emporia, Kans.	Sept. 20	**Stilbus apicalis** (Melsh.) (1)	
June 27	Allen, Kans.	Sept. 20	**Phalacrus politus** Melsh. (1)	
June 23	Pierceville, Kans	Sept. 20	**Phalacrus politus** Melsh. (1)	
			Lathridiidae	
June 27	Junction City, Ks.	Sept. 20	**Melanophthalma distinguenda** Com. (3)	Breeds in dried vegetable matter, milled cereal, etc.
June 30	Lowemont, Kans	Sept. 20	**Melanophthalma distinguenda** Com. (4)	
June 30	Lowemont, Kans.	Sept. 20	**M. simplex** (Lec.) (2)	
June 29	Waverly, Mo.	Sept. 20	**M. simplex** (Lec.) (3)	
			Melyridae	
June 26	Hamilton, Kans	Sept. 20	**Collops quadrimaculatus** (F.) (1)	The soft winged flower beetles are said to be predaceous.
			Curculionidae	
June 23	Dodge City, Kans.	Sept. 20	**Smicronyx caseyi** Blatch. (2)	These three weevils may have been associated with the wheat heads bv accident
June 26	Lawrence, Kans.	Sept. 20	**Anthonomus albopilosus** Dtz. (1)	
Aug. 1	Wheeler, Kans.	Sept. 20	**Stictobaris cribrata** (Lec.) (1)	

advevna (Waltl.) and the hairy fungus beetle (**Typhaea stercorea** (L)) are also very common in cornfields, particularly on tips of ears where rotting of the kernels occurs. Of the true pests of stored grain, the rice weevil was reared from only one sample taken in Kansas and none from the other states. In Texas, adults of the rice weevil were noticed on the wheat heads in the field at the time of collection, but the number of samples taken were evidently too few to show infestation by this pest. The Angoumois grain moth was reared from wheat heads collected in Texas and Missouri. The occurrence of dermestid beetles in some of the samples may have represented contamination of the samples while in storage; however, dermestid beetles have been collected on wheat heads in the field.

A further study of field infestation of wheat was made in 1939. Samples of wheat heads were collected from uncut fields during June and July from western Missouri and from parts of Kansas.

In all, approximately 150 samples were collected, placed in tightly closed boxes, and held for emergence. Conditions apparently were ideal for field infestation of grain. The grain when collected was fully mature, and an unusual abundance of rain at harvest time resulted in the wheat being particularly susceptible to infestation. The samples were examined in the latter part of September. A record of the insects found with the grain at that time is given in Table 2.

It may be noted from the data of Table 2 that insects were found in only eleven of the samples taken. In no case was either the Angoumois grain moth or the rice weevil found, and in about half the samples in which insects were found these were not pests of grain and were probably associated with the wheat heads accidentally.

From the foregoing studies it would seem unlikely that the heavy infestation of farm-stored grain that is prevalent in this region this year could have begun in the field.

NEW RECORDS OF LEPIDOPTERA FOR SUMNER COUNTY, KANSAS

Phoebis sennae marcellina (Cramer). A single female was taken in Sumner County, Kansas on September 22, 1940 by Dr. J. R. Turner. This visitor had not been previously recorded from Sumner County.

Phoebis sennae marcellina f. pallida (Cockerell). A single female was taken in Sumner County, Kansas on September 22, 1940 by Mrs. Stallings. This is another new visitor to Sumner County, Kansas.

Strymon ontario (Edw.). Three specimens were taken in Sumner County, Kansas on June 15th, 1940 by Mr. and Mrs. H. E. Jenista. This species appears to be a new resident of Sumner County.

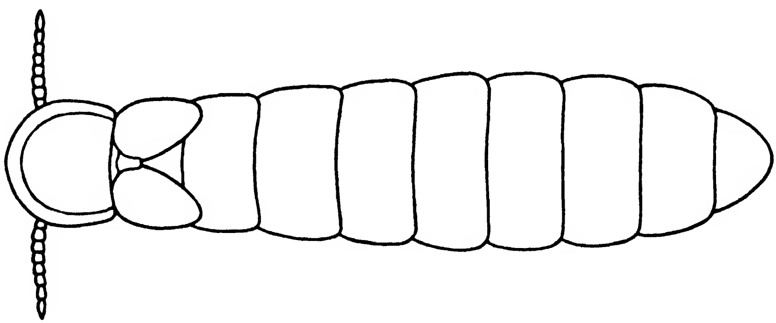
DON B. STALLINGS, Caldwell, Kansas

AN APTEROUS FEMALE PHOTINUS
(Coleoptera, Lampyridae)

John Wagener Green, Easton, Pa.

A small section of the genus Photinus, comprising **dimissus** Lec., **collustrans** Lec. and **granulatus** Fall, is characterized by the short and stout antennae and by the very large eyes of the male being closely approximate beneath, approaching the structures to be seen in Microphotus. A female example in the Kansas State College collection, thought to be **granulatus**, carries the analogy still further. It may be described as follows.

Body slender, claviform; pale reddish yellow above and beneath, antennae fuscous, pronotum with indefinite discal cloud wider in front, elytral disc and basal part of dorsal segments slightly darker. Antennae 11-jointed, short and compact, slightly fusiform, one-fourth longer than pronotum, joints 1, 3, 10 and 11 longer than wide, the others subquadrate. Front roughly sculptured, with three vague and shallow pits, one anterior and two within a tangent to the posterior margins of the eyes. Eyes rather small, separated by one and three-fourths times their width, very slightly closer beneath. Pronotum feebly transverse, broadly rounded in front, widest just before middle thence narrowed to base, hind angles narrowly rounded; disc irregularly granulate-punctate, median line depressed, sides explanate.



Elytra small, dehiscent, attaining basal fourth of first dorsal segment, not distinctly granulose. Abdomen with eight segments, surface irregularly and densely subgranulose, seventh dorsal with a narrow smooth median line on basal half.

Metasternum very short, its episterna terminating at one-half its lateral length. Lateral extension of posterior coxae bent obliquely forward to meet tip of episternum, broadly truncating the metasternal hind angles and affording a view of the sides of the usually concealed true first ventral segment. Darker median areas, apical on the sixth ventral and basal on the seventh (penultimate),

may indicate feeble light organs. These areas are not differently sculptured from the balance of the ventral surface. Legs normal. Length 6.5 mm.

Manhattan, Kansas, July 2, 1924, collected by D. Kenberry.

Photinus granulatus Fall, Bull. Brook. Ent. Soc., XXII, page 209, was described from two males taken at Lawrence, Kansas. Mr. Fall stated that the granulate pronotum is a unique character in our species so the probability is very great that the above described female is **granulatus**. I am indebted to Prof. George A. Dean, of Kansas State College, for the opportunity to study this specimen, as well as three Kansas males agreeing well with Fall's description.

TWO NEW SPECIES OF ERYTHRONEURA

R. H. Beamer, Lawrence, Kansas*

Erythroneura penapacha n. sp.
(Homoptera-Cicadellidae)

Erythroneura apacha Beamer (not Baker), Ann. Ent. Soc. Am., 1930, p. 431.

Resembling **apacha** Bk., but larger, color yellowish white, with very faint indication of oblique vitta on elytra, pygofer hooks long instead of short and broad, and aedeagus with two pairs of processes.

General ground color yellowish white. Vertex with a rather small sooty black spot either side middle, separated from each other and from eyes by more than their diameter. Pronotum somewhat fumose. Scutellum with black spot in each basal angle. Elytra with indications of lemon yellow, oblique vittae, tips slightly fumose.

Genitalia: Styles of the western type, foot small. Pygofer with two processes and a large seta; dorsal process shorter, almost straight, ventral process narrower and longer, curved sickle-shaped; aedeagus with shaft almost straight in dorsal view, with apical pair of lateral processes more than half as long as shaft, projecting away from shaft at about 45 degrees, and a pair of basal processes about as long as shaft and closely appressed to it.

Holotype male, allotype female, two male and three female paratypes, Brownsville, Texas, June 29, 1938, R. H. Beamer. One male paratype, Victoria, Texas, July 29, 1903.

Erythroneura biramosa n. sp.

Resembling **opulenta** externally, but color marks orange instead of red, base of foot of style forming almost a half circle and posterior point more than half as long as base.

Ground color of summer specimens yellowish white, markings

*Contribution from the Department of Entomology, University of Kansas.

orange. Vertex with one more or less round median spot. Pronotum usually with anchor-shaped mark, hooks of anchor along anterior margin. Elytra with dash along claval suture, half its length, a spot on outer third of clavus, a small spot on costa at base and an angular vittae arising on costa at anterior end of costal plaque, surrounding it and ending in cross-veins near middle of elytra, apical cells more or less suffused with darker.

Genitalia. Style with foot short, heel prominent, foot curved into almost half-circle; anterior point short, less than a right angle; posterior point more than half as long as base of foot, sharp; aedeagus of median size in dorsoventral view, widest at base, slightly longer than twice basal width; pygofer hook long and slender, reaching slightly beyond pygofer, curved out slightly at tip.

Holotype male, allotype female. and numerous male and female paratypes, Kenna, New Mexico, July 16, 1936, R. H. Beamer. Swept from dwarf oak.

Types deposited in Snow Entomological Collection.

ADDITIONAL NOTES ON **GALGUPH LOBOPROSTETHIA** SAILER
(Thyreocorinae)

R. I. Sailer, Lawrence, Kansas*

Through the kindness of Doctors R. C. Smith and R. H. Painter of Kansas State College, C. E. Mickel of the University of Minnesota, and H. H. Ross of the University of Illinois, I have been able to study considerable additional material of the species **G. loboprostethia** resulting in the following additional locality records which are worthy of mention: Olkwood, Ill., June 18, 1926, collected by Frisan and Hayes; Sioux City, Iowa, June 3, 1926, collected by C. N. Ainelie.

Professor H. G. Barber has recently further extended the bounderies of this species; he reports having received for determination a number of specimens collected in Hamilton County, Tenn., April 22, by W. F. Turner.

The following host records were obtained from a series of 43 specimens bearing Manhattan, Kansas, as a locality record, the majority having been collected by Doctors R. C. Smith and D. A. Wilbur of Kansas State College: 27 specimens taken on alfalfa, 1 on corn and another on yellow sweet clover, the remainder bearing no host records. Of the specimens taken on alfalfa, 23 were captured in July, 2 in May and 1 each in September and October.

*Contribution from the Department of Entomology, University of Kansas.

A NEW CORIXID FROM CHINA

H. B. Hungerford, Lawrence, Kansas*

For many years I have had a moderately large Corixid that has remained unnamed in our collection of Chinese Corixidae. It is certainly distinct from any of the species that have been described or redescribed in recent years.

Sigara suensoni new species

Size: Length 7.8 to 8.2 mm.; width across the head 2.7 mm.

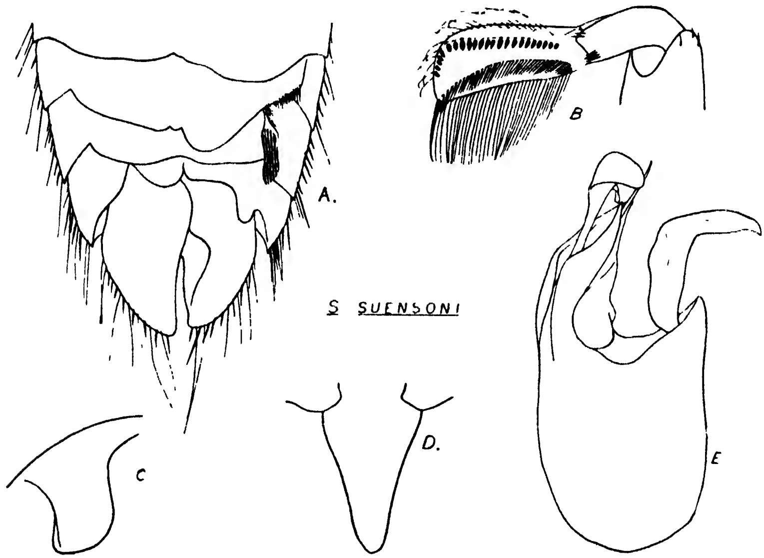
Color: General facies light to medium brown. Head, legs and venter yellowish. The pronotum crossed by eight or nine brown lines, the last five or six united at their ends by a marginal band. The dark lines usually a little broader than the yellow interspaces. The pale figures of the hemelytra slender, transverse, in wavy, broken lines. The line between corium and membrance faintly marked, the pattern figures crossing it usually without interruption.

Structural Characteristics: Head of male, when viewed from above, a little more than half the length of the pronotal disk, the frontal arch but slightly produced—alike in both sexes. Facial impression of the male slight. Interocular space about 5/6 of eye width in male, slightly wider in female. The post ocular space narrow, laterally, but rather broad at inner angle of the eyes due to the median projection of the hind margin of the head. The third antennal segment is to the fourth as 19:10. Only faint indication of median carina on anterior margin of pronotum. Dorsal surface of insect shiny, the pronotal disk and hemelytra faintly rugulose. Lateral lobe of prothorax quadrate and slightly oblique on distal end. Metaxyphus long and slender. Abdominal dorsum of male as shown in text figure, the strigil long and narrow; male genital capsule as shown in text figure. The oblique distal portion of the right clasper appears palaform on its inner surface when viewed from the front. The penis sheath expanded at the tip, as shown in the drawings.

The male pala of the typical Anticorixa shape with a row of about 24 pegs, which are smaller at the ends of the row. The anterior femur without stridular patch of pegs. The measurements of the middle leg as follows: Femur: tibia:tarsus: claws:: 100:38:33:38. The measurements of the hind leg: Femur:tibia:1st tarsal:2nd tarsal::57:55:68:20.

Described from four males and nineteen females labeled "Soochow, China, June 10, 1923. E. Suenson" and two females labeled "Soochow, China, April 29, 1923. E. Suenson." These last two are a little darker than those taken in June, which evidently are from a newly emerged brood, so that the typical color is probably medium

*Contribution from the Department of Entomology, University of Kansas.



instead of light brown. The holotype and allotype from the June 10 series. Types in Francis Huntington Snow Collection, University of Kansas.

Comparative Notes: This species has a male pala of same general shape as that of **Sigara linnae** (Fieb.). It is a little broader species than Fieber's species, does not have a rastrated surface, and the color pattern of hemelytra is much more broken. Its smaller size readily separates it from the large species of Sigara described from the region in recent years by Lundblad, Jaczewski, and myself.

NEW RECORDS OF BUTTERFLIES FOR KANSAS

Hemiargus cyna (Edw.) A single perfect male specimen of this butterfly was taken in Sumner County, Kansas on April 3rd, 1940. For the present this species can only be regarded as a visitor in Kansas; however, it has been this writer's observation that species first recorded in the spring or early summer are often later proven to be residents of that vicinity. Taken by the writer.

Megisto hermes f. sosybius (Fabr.) A single male specimen of this butterfly, slightly damaged, was taken in Sumner County, Kansas on October 3rd, 1940. There is little question but that this is merely a visitor to Kansas. Taken by Mrs. R. C. Turner, Jr.

DON B. STALLINGS, Caldwell, Kansas

INSECT INFESTATION IN RAILWAY BOX CARS IN WHICH WHEAT HAS BEEN SHIPPED

Temple F. Winburn, Bureau of Entomology and Plant Quarantine

During the summer of 1939 a study was made of the insect population of empty railway box cars that had been used for carrying grain as indicated by the insects removed in the routine process of cleaning the cars with a jet of compressed air. Visits were made to railroad yards at Atchison, Kans., and St. Joseph, Mo. during the early part of June before much of the grain crop had been carried, and to Atchison, Kansas., again in the latter part of July after the rush of the grain-carrying season was over.

In cleaning box cars a stream of compressed air is applied to the entire inside surface of the car by means of a hose and nozzle, particular attention being given to cleaning behind grain linings, in the corners, and along the cracks in the floor and sides. In many cars accumulations of grain, varying in size from a handfull to

Table 1.—Insect infestation of railway box cars in June 1939

Idenity of car	Type of grain lining	Number of species of insects found in material blown from cars
A. C. & Mo.	Single	3 Rice weevils **Sitophilus oryza** (L.)), dead.
		1 Black carpet beetle larva (**Attagenus piceus** (Oliv.)), alive.
		1 Small-eyed flour beetle (**Palorus ratzeburgi** (Wissm.)), alive.
A. Mo. 90494	do.	1 Small-eyed flour beetle, alive.
		Many book lice (**Liposcelis divinatorius** (Müll.)), alive.
		2 Cadella larvae (**Tenebroides mauritanicus** (L.)), alive.
C. B. & Q.	Double	3 Confused flour beetles (**Tribolium confusum** J. duV.), alive.
		3 Confused flour beetle larvae, alive.
		1 Rice weevil, dead.
West'n Pac. 17751	Single	1 Black carpet beetle adult, alive.
C. B. & Q. 120262	Double	1 Flat grain beetle (**Laemophloeus minutus** (Oliv.)), alive.
C. B. & Q. 105254	do.	No insects found.
C. B. & Q. 113548	do.	No insects found.
C. B. & Q. 110722	Single	No insects found.
C. B. & Q.	do.	2 Granary weevils (**Sitophilus granarius** (L.)), dead.
		1 Small-eyed flour beetle, alive.
		4 **Cryptophagus dentatus** Hbst., alive
C. B. & Q. 11645	do.	No insects found.
Seab'd Airl'e 17926	do.	No insects found.
C. B. & Q.116140	do.	2 Confused flour beetle larvae, alive.
C. B. & Q. 130873	do.	1 Confused flour beetle larva, alive.
C. B. & Q.111913	Double	No insects found.

several pounds, are found behind the grain lining, and blowing with air must be supplemented by beating on the lining to jar the grain loose. At the end of the cars, where there is no opening in the lining at the floor level, holes are either bored in the lining or, if possible, a section or two is removed to allow for the insertion of the air nozzle and blowing out the grain. The cleanings removed from the cars usually consisted of grain, dust, and insects. A careful examination was made of all material removed from each car and any insects found were taken to the labortory for identification.

In the early part of June, 14 cars that had been used to carry grain were taken at random and cleanings from them examined. The number and species of insects found in each car are recorded in Table 1.

As shown by the data of Table 1, 8 of the 14 cars examined contained some insects. Nine different species of insects were represented in the collection but in no case were the numbers large. This would appear to represent the condition of the average grain-carrying car before the main grain-shipping season.

Examination at Atchison, Kans., late in July of 24 box cars that had been actively engaged in crrying grain prsented a rather different picture. Data regarding the insect infestation found in these cars are given in Table 2.

Table 2.—Insect infestation of railway box cars in July, 1939

Idenity of car	Type of grain lining	Number of species of insects found in material blown from cars
M. P. 42645	Double	1 Rice weevil (**Sitophilus oryza** (L.)), dead.
M. P. 42155	Single	1 Cadelle larva (**Tenebroides mauritanicus** (L.)), alive.
M. P. 90096	do.	29 Sawtoothed grain beetles (**Oryzaephilus surinamensis** (L.)), alive
		3 Small-eyed flour beetles, alive.
		1 Small-eyed flour beetle, dead.
		1 Small-eyed flour beetle larva (**Palorus ratzeburgi** (Wissm.)), alive.
		9 Flat grain beetles (**Laemophleous minutus** (Oliv.)), alive.
M. P. 41236	do.	1 Cadelle adult, alive.
		1 Cadelle adult, dead.
		2 Cadelle larvae, alive.
		2 Black carpet beetle larvae (**Attagenus piceus** (Oliv.)), alive.
		1 Confused flour beetle (**Tribolium confusum** J. du V.), dead.
		1 Small-eyed flour beetle, dead.
M. P. 48217	do.	4 Confused flour beetles, alive.
		2 Confused flour beetles, dead.

Table 2—continued

Idenity of car	Type of grain lining	Number of species of insects found in material blown from cars
		37 Confused flour beetle larvae, alive.
		8 Cadelle larvae, alive.
		6 Flat grain beetles, alive.
		Numerous book lice (**Liposcelis divinatorius** (Müll.)), alive.
N. Y. Cent. 151688	Single	1 Flat grain beetle, dead.
		1 Black carpet beetle larva, alive.
		1 Larger cabinet beetle (**Trogoderma versicolor** (Creutz.)), alive.
Norf'k & Sou. 25241	do.	1 Rice weevil, dead.
C. B. & Q. 15380	do.	2 Confused flour beetles, dead.
C. B. & Q. 109429	Double	2 Sawtoothed grain beetles, alive.
		1 Flat grain beetle, alive.
		1 Rice weevil, dead.
C. B. & Q. 99927	Double	2 Confused flour beetles, alive.
		2 Confused flour beetles, dead.
		5 Small-eyed flour beetles, alive.
		1 Small-eyed flour beetle larva, alive.
		1 Granary weevil (**Sitophilus granarius** (L.)), alive.
		1 Cadelle beetle, alive.
		1 Cadelle larva, alive.
		4 Black carpet beetle larvae, alive.
Frisco 127668	Single	1 Cadelle larva, alive.
		1 Small-eyed flour beetle, alive.
U. P. 182142	do.	4 Granary weevils, alive.
Southern 10796	do.	1 Sawtoothed grain beetle, alive.
C. B. & Q. 119997	Double	1 Cadelle adult, dead.
C. B. & Q. 130814	do.	1 Flat grain beetle, alive.
C. B. & Q. 112633	do.	2 Black carpet beetle larvae, alive.
C. B. & Q. 100049	do.	6 Confused flour beetles, alive.
C. B. & Q. 109365	do.	1 Two-banded fungus beetle (**Alphitophagus bifasciatus** (Say)), alive.
		4 Cadelle larvae, alive.
		130 Dark mealworm larvae, (**Tenebrio obscurus** F.), alive.
		12 Dark mealworm larvae, dead.
		6 Lesser mealworm larvae (**Alphitobius diaperinus** (Panz.)), alive.
		1 Cadelle adult, alive.
		1 Cadelle adult, dead.
		12 Flat grain beetles, alive.
North'n Pac. 13766	do.	1 Rice weevil, dead.
C. B. & Q. 103474	Double	1 Confused flour beetle, alive.
C. B. & Q. 114597	do.	1 Rice weevil, alive.
		19 Black carpet beetle larvae, alive.
So. Pac. 29360	Single	5 Small-eyed flour beetles, alive.
		2 Small-eyed flour beetles, dead.
		2 Cadelle larvae, dead.
		6 Hairy fungus beetles (**Typhaea stercorea** (L.)), alive.
Ill. Cent. 157985	do.	No insects found.
C. B. & Q. 119819	Double	No insects found.

As can be seen from the data of Table 2, of the 24 cars examined only 2 were without a visible supply of insects. Fourteen different species of insects were represented, in some cases as many as five different species in the same car. The number of insects per car was in many cases high, as many as 153 being found in a single car.

It is evident that in the early part of the season before extensive shipments of grain are made, about 50 percent of grain-carrying cars are likely to carry a light infestation of insects, but after the rush of the grain-carrying season, a majority of the cars are heavily infested with insects.

THE ALFALFA PLANT BUG, ADELPHOCORIS LINEOLATUS (GOEZE), FOUND IN KANSAS

Charles Curtiss, Kansas State College

While taking insect sweepings in an alfalfa field on the Kansas State College agronomy farm at Manhattan, Kansas, during the third week of August, 1939, the writer discovered in his net several large pale Mirids of a species which he had not previously collected. It was suspected that they were **Adelphocoris lineolatus** (Goeze), first reported in the United States by Knight (1930a), at Ames Iowa.

Several specimens were taken for pinning, but were accidentally lost. Later efforts to replace them by sweeping alfalfa were unsuccessful. A single specimen was found, however, among a group of insects swept from alfalfa at Manhattan, August 22, 1939, by Donald Yost, a student in the Kansas State College entomology deprtment. This specimen was sent for determination to Dr. H. H. Knight of Iowa State College, who identified it as **Adelphocoris lineolatus** (Goeze).

This is the first record of the insect in Kansas. It is a native of Europe, and until 1929 was known in North America only from Cape Breton Island, Nova Scotia, where it was recorded by Knight (1922). In June, 1929, Knight (1930a, 1930b) found it in a limited area surrounding Ames, Iowa. He proposed the common name "alfalfa plant bug" for **A. lineolatus**, as the majority of specimens taken were swept from alfalfa or sweet clover, (Knight, 1930b).

If this species becomes common in alfalfa and clover fields in Kansas, as seems entirely probable, it may well become a real pest. Its injury to alfalfa has been noted repeatedly by Russian workers. Zolotarevsky (1915) stated that great damage to alfalfa resulted from infestations of **A. lineolatus**. Injury of 10 per cent of the flower buds of first year alfalfa grown for seed was reported by Ponomarenko (1935). It is known that the closely related New World species, **A. rapidus** (Say), which occurs through most of the

United States, and A. **superbus** (Uhl.) a western species, are factors in reducing alfalfa seed production.

Other favored food plants of A. **lineolatus** were indicated by Golledge (1915), who mentioned chrysanthemums, onions, and beets, as well as alfalfa. He even referred to the species as the "chrysanthemum bug." Vasiliv (1924) listed it among insects injurious to cotton in Russia.

It is desirable that collectors in Kansas and adjoining states be on the alert for specimens of A. **lineolatus**, so that an up-to-date record of its spread from Ames, Iowa, the apparent point of introduction in the United States, may be maintained.

The alfalfa plant bug is very similar in general form to the rapid plant bug, A. **rapidus**, but is slightly larger than that species, and is much paler, the pre-dominant color being yellowish-green. Those familiar with the rapid plant bug will have little difficulty in recognizing **lineolatus** on the basis of these general points of similarity and difference. Knight (1930a, 1930b) gave good general descriptions of the male, female, and fifth instar of A. **lineolatus**.

LITERATURE CITED

Golledge, C. J.*

The insects injurious to chrysanthemums in Britain Jour North of England Hort. Soc. Leeds. Nos. 53-54. August-September, 1915 pp. 205-216. (From Rev. Appl Ent. Ser. A. 3: 746-47. 1915).

Knight, Harry H.

Nearctic records for species of Miridae known heretofore only from the Palearctic region (Heterop.) Can. Ent 53: 280-88. 1922.

———An European plant-bug (**Adelphocoris lineolatus** Goeze) found in Iowa (Hemip Miridae). Ent News 41: 4-6 Jan., 1930a.

———"Alfalfa plant bug," a common name for an introduced European bug. . . Jour Econ Ent. 23. 331-34. April, 1930b

Ponomarenko, D. A.*

Entomological factors that lower the seed production of lucerne. (In Russian). Plant Prot 1935. Fasc. 3, pp. 109-10. Leningrad, 1935. (From Rev Appl Ent. Ser. A. 23: 616. 1935.).

Vasiliv, I. V.*

Cotton pests. (In Russian). Cotton Indust. iii, no. 7-8 pp. 86-116. Moscow July-August, 1924 (From Rev. Appl. Ent. Ser. A. 12: 555-56. 1924.)

Zolotarevsky, B. N.*

Preliminary report on the work in entomology in 1914. (In Russian). Stavropol. Stavropol—Caucasian Agr. Exp Sta. of the Stavropol Municipal Authority. 1915. (From Rev Appl. Ent. Ser. A 3: 479-80. 1915).

*Original not seen.

A FREAK BUTTERFLY

On October 5th, 1940 in Sumner County, Kansas a freak butterfly was captured by John Huen.

Both hind wings of this butterfly and the left forewing are typical of a female **Colias eurytheme f. amphidusa ab. alba** (Stkr.) being greenish white with the usual black markings. The right forewing is typical of a male **Colias eurytheme f. amphidusa** (Bdv.) being a bright orange yellow with the usual black markings.

DON B. STALLINGS, Caldwell, Kansas

THE ROBBER FLIES OF COLORADO
(Diptera, Asilidae)*

Maurice T. James, Colorado State College

The present paper represents the results of the work of the past ten years on this interesting family of Diptera as it occurs in Colorado. The study is made primarily from the zoogeographical, rather than from the systematic standpoint; but the citations of the most recently published key, review, or monographic treatment of each genus, the inclusion of a key to the Colorado genera and species whenever (with one exception) no adequate one exists, and the citation of the original description of each species, should enable the student who has access to ordinary entomological literature to make determinations. Foundation works, other than those cited, which will aid considerably in making determinations, but which can not as a rule be used without supplement, are those of Back (1909), Bromley (1934), and Hine (1909, 1911, and 1919).

Some published records of Colorado Asilidae have been gleaned from the literature, the most important papers, in addition to the Back and Hine works above cited, being those of Tucker (1907 and 1908), Cockerell (1917) and Brown (1929). Certain records of these workers have not been used, however, because of the fact that in some genera early determinations are not always reliable.

The material used in this study came chiefly from the following sources: (1) The collection of the University of Colorado. This includes earlier material accumulated by Dr. Cockerell and others; the collections obtained in the expedition of Mr. H. G. Rodeck and the writer through the eastern and southeastern counties of Colorado in July and August, 1933; the collection of Mr. Urless Lanham and Mr. Robert Bauer in west-central Colorado in 1938; the collections of Mr. H. G. Rodeck and Mr. Urless Lanham at Science Lodge, near Ward; the collections of Mrs. Helen B. Rodeck in the Rocky Mountain National Park; and others. (2) The collection of the Colorado State College. This includes earlier material accumulated by Dr. C. P. Gillette, Dr. C. R. Jones, and others; the material collected by the writer and his wife, particularly in Weld, Boulder, Larimer, and Crowley counties; the collections of the James and Lanham expedition to central and south-central Colorado in July, 1938; and others. (3) The important collections made by Rev Father Bernard Rotger, particularly in the southwestern counties of the State.

I am indebted to all who have so generously collected for me and lent me material; also to Dr. S. W. Bromley for some determina-

*Condensed from the systematic part of a thesis submitted in June, 1938, to the Graduate School of the University of Colorado, in partial satisfaction of the degree of Doctor of Philosophy, and brought up to date by the addition of information since accumulated.

tions in the genera **Stenopogon, Diogmites, Mallophorina,** and **Asilus,** and to Dr. Joseph Wilcox for determinations in the genera **Cyrtopogon** and **Lasiopogon.** Most of the determinations, with both the credit and blame attached thereto, are my own; this is true of the Rotger collection, although some of the data used in this paper are from determinations made by Dr. Bromley and relayed to me by Father Rotger.

KEY TO THE GENERA*

1. Marginal cell open ---------- 2
   Marginal cell closed and petiolate ---------- 3
2. Antennae with a slender terminal arista; palpi one-segmented; alula lacking; very slender species (Leptogastrinae) ---------- LEPTOGASTER
   Antennae without a slender terminal arista, frequently with a style; palpi two-segmented; alula present (Lasypogoninae) ---------- 4
3. Antennae with a slender terminal arista; usually elongated species (Asilinae) ---------- 27
   Antennae without a terminal arista, sometimes with a style; usually more robust species (Laphriinae) ---------- 35
4. Claws long, slender, without pulvilli ---------- 5
   Claws shorter, with evident pulvilli ---------- 6
5. Mystax confined to the oral margin ---------- HODOPHYLAX
   Mystax extending onto the face ---------- ABLAUTUS
6. Anterior tibia terminating in a sharp, curved, ventral spur ---------- 7
   Anterior tibiae with only straight or gently curved apical bristles ---------- 12
7. Middle of mesonotum raised and bearing a crest of long, dense hairs ---------- COMANTELLA
   Mesonotum never with a crest of dense hair ---------- 8
8. Face bare, with bristles on the oral margin, in profile straight or gently concave, the oral margin most prominent ---------- 9
   Face convex below, more or less covered with hairs, the oral margin not the most prominent ---------- 10
9. Fourth posterior cell closed and petiolate at the apex; antenna without a distinct style ---------- DIOGMITES
   Fourth posterior cell open or closed in the margin; antenna with a distinct style ---------- SAROPOGON
10. Third antennal segment more or less dilated, the style very short ---------- LESTOMYIA
    Third segment slender, elongate ---------- 11

*In constructing the following key I have made free use of those of Curran's **North American Diptera** and Bromley's **Asilidae of Texas.** Both these works will be found useful supplements.

11. Scutellum without bristles or hair ---------------COPHURA
Scutellum with marginal bristles ---------------BUCKELLIA
12. Head slightly higher than broad; face narrow above, swollen and broadened below ---------------------------13
Head obviously broader than high -------------------------14
13. Antenna with a terminal style ---------------STENOPOGON
Antenna without a visible style --------------OSPRIOCERUS
14. Fourth posterior cell closed ----------------------------15
Fourth posterior cell open, rarely almost closed -----------17
15. Face hairy above the mystax; medium sized flies -----------16
Face bare except along the oral margin; very large flies
--MICROSTYLUM
16. Antenna with a short, broad, easily distinguishable, two-segmented style ----------------------------LAPHYSTIA
Antenna without a distinct style ----------------PSILOCURUS
17. Antennal style as broad as the third antennal segment and simulating a segment, sometimes closely appressed and not easily differentiated ---------------------------18
Antennal style narrower than the third segment or absent ---19
18. Nearly bare species; abdomen narrow and cylindrical; lateral slopes of the metanotum bare ------------DIOCTRIA
More pilose species; abdomen short; lateral slopes of the metanotum pilose ----------------------------DICOLONUS
19. Face bare, except on the oral margin --------STICHOPOGON
Face with hair between the mystax and oral margin, or evenly haired ---------------------------------------20
20. Mesonotum with the dorsocentral bristles strong and extending in front of the suture; if rather weak anteriorly, there are no acrostical hairs --------------------21
Dorsocentrals absent or not strongly differentiated; mesonotum hairy, the acrostical hair always present ----------23
21. Acrostical hairs present, usually abundant but short
---LASIOPOGON
No acrostical hairs ------------------------------------22
22. Mystax composed of a few very stout, scattered bristles ---COLEOMYIA
Mystax composed of more numerous, ordinary bristles --METAPOGON
23. Mesonotum with the hair appressed and with distinct subappressed dorsocentrals posteriorly; middle tibiae ending in a straight spur ---------------------WILCOXIA
Mesonotal hairs erect, the bristles, if any, fine and erect ------24
24. Face decidedly gibbous, the swelling clearly limited above ----25
Face flat or evenly, gently convex ----------------------26

25. The third vein branches before the apex of the discal cell; style about half as long as the third segment ---------------------------------------EUCYRTOPOGON
The third vein branches conspicuously beyond the apex of the discal cell; style one-fourth or less the length of the third segment ---------------------CYRTOPOGON
26. Posterior tibiae swollen, about twice as large as the anterior ones ---------------------------------HOLOPOGON
Posterior tibiae not enlarged ---------------HETEROPOGON
27. The posterior branch of the third vein meets the costa beyond the apex of the wing --------------------------28
The posterior branch of the third vein meets the costa before the apex of the wing ----------------------------34
28. Slopes or lateral swellings of the metanotum pilose --------29
Slopes of lateral swellings of the metanotum without pile ----30
29. Ovipositor of the female without apical spines; male genitalia compact, never leaving a large open space from the dorsal view ------------------------------ASILUS
Ovipositor of the female armed at apex with six stout, short spines; forceps of male genitalia strongly curved and leaving a large open space on the apical half PHILONICUS
30. Claws acute apically; abdomen elongated ------------------31
Claws blunt, obtuse apically; abdomen short, thick, hairy ----33
31. Three submarginal cells, the second and third divided by a cross-vein which is situated well beyond the apex of the discal cell ------------------------------PROMACHUS
Two submarginal cells; in rare instances (some Erax) three, but in such cases, the cross-vein separating the second and third is well before the apex of the discal cell---32
32. Face only weakly gibbous; ovipositor ending in a circlet of spines --------------------------PROCTACANTHELLA
Face with a strong gibbosity occupying the lower half or more; ovipositor not ending in a circlet of spines ----ERAX
33. Face evenly, gently convex, evenly pilose, the oral margin with bristles ------------------------MALLOPHORINA
Face more or less strongly gibbous below, not uniformly pilose ---------------------------------------MALLOPHORA
34. Ovipositor of the female cylindrical, ending in a circlet of spines; abdomen of male longer than the wings; second submarginal cell never angulate or with a spur at its base ---------------------------PROCTACANTHUS
Ovipositor of the female without spines, rarely cylindrical; abdomen of male frequently shorter than the wings; second submarginal cell usually angulate, often with a spur at the base -------------------------ERAX

35. Wings with three submarginal cells ---------- POGONOSOMA
Wings with only two submarginal cells ------------------ 36
36. Third antennal segment with a short blunt apical style, See **Laphystia.** Two species of **Asilus** may also run. here.
Third antennal segment without a style ------------------- 37
37. Veins at distal end of discal and fourth posterior cells parallel or continuous in the same straight line; body punctulate; first antennal segment not more than twice as long as the second -------------------------- ATOMOSIA
Veins at distal end of the discal and fourth posterior cells very distinctly angulated and not parallel ---------- 38
38. Proboscis slightly pointed and upturned in profile at tip; palpi broadened and truncate at tip ------- ANDRENOSOMA
Proboscis truncate, long; palpi slender and rounded at tip ---- 39
39. Bare species; hind femora usually with tubercles below; tips of antennae slightly curved ----------------- LAMPRIA
Usually more pilose species (exception, **Laphria felis**); antennae straight ------------------------------------- 40
40. Densely pilose species; abdomen short and broad, generally broader beyond the middle ----------- BOMBOMIMA
Less pilose, the hairs short; abdomen more cylindrical LAPHRIA

LEPTOGASTER Meigen

Key to Species found in Colorado

1. Antennae wholly yellow; hind femora each with a conspicuous patch of white pile below----------------- **hirtipes**
At least the first and third antennal segments black; hind femora without a conspicuous patch of white pile below -- 2
2. Antennae wholly black ---------------------------------- 3
Second antennal segment red ----------------------------- 4
3. Middle and hind femora, hind tibiae, and usually middle tibiae conspicuously marked with black, or blackish; occipital bristles pale ---------------------------- **arenicola**
Only the hind femora and tibiae with black markings; upper occipital bristles black (Nebraska; may occur in Colorado) ------------------------------------ **murinus**
4. Legs yellow or reddish -------------------------- **coloradensis**
All femora and tibiae with conspicuous black markings -- **eudicranus**

1. **Leptogaster hirtipes** Coquillett, 1904. Proc. Ent. Soc. Wash., 6:178. Recorded from Colorado by Back. Poncha Pass, Colo., Aug. 3, 1938 (James and Lanham); Lake City, Aug. 8 to 21, 1938 (C. L. Fluke).

2. **Leptogaster arenicola** James, 1937, Ent. News, 48:13. The original name **arenicolus** is an error; **arenicola** is a noun in apposition, not an adjective. Eads (holotype); Fort Collins. July and August.

3. **Leptogaster coloradensis** James, 1937. Ent. News, 48: 14. Holotype from Boulder. Hamilton; Ft. Collins. Common in the College pasture near Ft. Collins in June and early July; its place is taken in July by **L. arenicola.**

4. **Leptogaster eudicranus** Loew, 1874, Berl. Ent. Zeit., 18: 353. Boulder; Ft. Collins; Hamilton. July.

HODOPHYLAX James.

Pritchard, 1938, Pan-Pac. Ent., 14: 129-131*

5. **Hodophylax aridus** James, 1933, Amer. Mus. Nov., 596, p. 2. Holotype from Crowley; recorded by James from Boone.

ABLAUTUS Loew.

Wilcox, 1935, Canad. Ent., 67: 222-227.

6. **Ablautus mimus** Osten Sacken, 1877, West. Dipt., 290. Denver, March 12, 1902 (S. A. Johnson); Durango, May 10, 1937 (Rotger); Arboles, May 10, 1937 and June 26, 1937 (Rotger); Tiffany, May 10, 1937 (Rotger).

COMANTELLA Curran

James, 1937, Pan-Pac. Ent., 13: 61-63.

7. **Comantella rotgeri** James, 1937. Pan-Pac. Ent., 13: 61. Holotypes from Stollsteimer (Francis). Recorded by James from Arboles., Pagosa Junction, Durango, and Tiffany. Ignacio. Mar, Apr., Oct., Nov.

8. **Comantella fallei** (Back), 1909, Trans. Amer. Ent. Soc., 35: 378. Holotype from Ft. Collins. Recorded by James frcm Denver; Colorado Springs; Kirk. Mar., Apr., and Oct.

DIOGMITES Loew.

Bromley, 1936, Jour. N. Y. Ent. Soc., 44: 225-237.

9. **Diogmites neoternatus** (Bromley), 1931, Ann. Ent. Soc. Amer., 24: 432. Recorded by Back from Rocky Ford (as **ternatus**) Olney Springs, July 16, 1927 (M. T. James); Las Animas, July 12, 1931 and Aug. 6, 1931 (Leonard Sweetman).

10. **Dicgmites coloradensis** (James), 1933, Amer. Mus., Nov., 596: 2 Boulder, Aug. 2 and 10, 1932 (type series); Pagosa Springs, Aug. 3, 1935 (Rotger); La Plata Co., June 16, 1934 (Rotger); Francis, July 8, 1935 (Rotger).

11. **Diogmites grossus** Bromley, 1936, Jour N. Y. Ent. Soc., 44: 236. Holotype from Lamar. Paratypes from White Rocks (near Boulder) and Wray. Paonia; Prowers; Eads; Masonville. Aug., Sept.

---

*Citations under the genus refer to the latest available key, review, or monograph. See page 27.

12. **Diogmites pulcher** (Back), 1909, Trans. Amer. Ent. Soc., 35: 361. Roggen, July 31, 1934 (James) and Aug. 29, 1930 (Rodeck).

13. **Diogmites angustipennis** Loew, 1866, Cent., VII, 41. Recorded by Cockerell from Boulder. Ft. Collins; Walker Hill, Crowley Co.; Lamport; Boone; Denver. Late July, Aug.

14. **Diogmites symmachus** Loew, 1872, Cent., X, 26. Boulder; White Rocks, near Boulder; Ft. Collins; Masonville; Lamport; Eads; Ordway; Huerfano Co. July to early Sept.

SAROPOGON Loew

Curran, 1931, Amer. Mus. Nov., 487, pp. 1-3.

15. **Saropogon combustus** Loew, 1874, Berl. Ent. Zeit., 18: 373. A dichromatous species; the male is black, the female, reddish yellow. Recorded from Ft. Collins by Back. Cheyenne Wells, July 27, 1933 (Rodeck and James); Las Animas, July 2 and 4, 1933 (Leonard Sweetman); Hygiene, Aug. 1, 1935 (Lanham).

LESTOMYIA Williston.

Curran, 1931, Amer. Mus. Nov. 487, pp. 3-4.

16. **Lestomyia sabulonum** (Osten Sacken), 1877, West. Dipt., p. 292. Maybell, June 17, 1907.

17. **Lestomyia strigipes** Curran, 1931, Amer. Mus. Nov., 487, p. 3. Seven miles South of Glade Park, July 23, 1938 (Lanham and Bauer).

COPHURA Osten Sacken

Curran, 1931, Amer. Mus. Nov., 487, pp. 4-10.

18. **Cophura lutzi** Curran, 1931, Amer. Mus. Nov., 487, p. 7. Holotype from "Regnier, Colorado." Regnier is in the Oklahoma panhandle, just over the Colorado line. The type specimen may have been taken on the Colorado side.

19. **Cophura clausa** (Coquillett), 1893, Canad. Ent., 25: 34. Durango, June 5 and 9, 1936 (Rotger); det. Bromley.

BUCKELLIA Curran

Curran, 1931, Amer. Mus. Nov., 487, pp. 4-8.

20. **Buckellia brevicornis** (Williston), 1884, Trans. Amer. Ent Soc., 11: 22. A.S.U.C. Lodge, near Boulder, July 1, 1932 and July 16, 1933 (James); Science Lodge, Boulder Co., Colo., July 15, 1939 (Lanham).

STENOPOGON Loew

Bromley, 1937, Jour. N. Y. Ent. Soc., 45: 291-309.

21. **Stenopogon inquinatus** Loew, 1866, Cent., VII, 47. Widespread. Recorded by C. J. D. Brown from Mesa Verde National Park. Hesperus; Francis; La Posta; Lonetree; Juanita; Glade Park; Delta; Monte Vista; Boulder; Lee Hill, near Boulder; Ward; Larimer Co., west of Horsetooth Mountain; Las Animas; Denver; Saguache. Late May to July.

22. **Stenopogon rufibarbis** Bromley, 1931, Ann. Ent. Soc. Amer., 24: 431. Lonetree, June 1, 1934 (Rotger); Trujillo, May 17, 1934 (Rotger); Glade Park, June 23, 1938 (Lanham & Bauer); Boulder Co., July 10, 1926 (C. H. Hicks).

23. **Stenopogon obscuriventris** Loew, 1872, Cent., X, 30. Durango; Trujillo, La Posta; Tiffany; Lonetree; Glade Park; Boulder Co.; Ft. Collins; Larimer Co., west of Horsetooth Mountain. May to July.

24. **Stenopogon martini** Bromley, 1937, Jour. N. Y. Ent. Soc., 45: 303. Creede, Aug., 1914 (S. J. Hunter), det. Bromley.

25. **Stenopogon aeacidinus** Williston, 1886, Trans. Amer. Ent. Soc., 13: 289. Recorded by Back from Bear Creek Canyon and from Denver (Osten Sacken). Platteville, Aug. 1, 1915 (C. R. Jones); Ordway, July 28, 1933 (Helen James); Burlington, July 27, 1933 (Rodeck and James).

26. **Stenopogon subulatus** (Wiedemann), 1828, Auss. Zweifl. Ins., I, 375. Recorded by Bromley from Colorado.

27. **Stenopogon consanguineus** Loew, 1866, Cent., VII, 48. Recorded by Back from Rocky Ford and by C. J. D. Brown from Ute Mountain (Tanner). Common on the eastern Colorado plains. Pinon; Roggen; White Rocks, near Boulder; Ft. Collins; La Porte; Chivington; Granada; Boulder Co. Late June to October.

28. **Stenopogon latipennis** Loew, 1866, Cent., VII, 49. Recorded by Bromley from Colorado.

29. **Stenopogon neglectus** Bromley, 1931, Ann. Ent. Soc. Amer., 24: 430. Paratypes from Creede. Widespread in the mountains: Villa Grove; Francis; Arboles; Hesperus; Pagosa Springs; Lonetree; Antonito; Gunnison; Home; Virginia Dale; Red Rocks Park, Morrison. June to early Sept.

30. **Stenopogon picticornis** Loew, 1866, Cent., VII, 45. Recorded by Back from the Denver Highland. Foothills and mountains: Boulder; Inspiration Point, near Denver; La Porte; Ft. Collins; Lonetree; Allison; Pagosa Junction. July to early Sept.

31. **Stenopogon coyote** Bromley, 1931, Ann Ent. Soc. Amer., 24: 429. Paratypes from Salida, Poncha Springs, and Garden of the Gods (Colorado Springs). Owen's Lake, near Valmont; Ft. Collins; Horsetooth Mountain, Larimer Co.; West Lake; Buena Vista; Lonetree. June to Aug.

32. **Stenopogon helvolus** Loew, 1874, Berl. Ent. Zeit., 18: 355. Boulder, La Porte; Denver; Two Buttes; Las Animas. July and Aug.

33. **Stenopogon uhleri** Banks. Holotype from "hills west of Denver."

OSPRIOCERUS Loew.

Bromley, 1934, Ann. Ent. Soc. Amer., 27: 81.

34. **Ospriocerus abdominalis** (Say), 1824, Long's Exped., App. 375. Recorded from Colorado Springs by Tucker, from Spanish Peaks and Colorado Springs by Back, and from Mesa Verde National Park by C. J. D. Brown. Common: Delta; Grand Junction; Arboles; Cortez; San Luis; Mesade Mayo, near Tobe; Grover; Boulder; Ft. Collins; Horsetooth Mountain, Larmier Co.; La Porte; Mishawauka, Larimer Co. June to Oct.

35. **Ospriocerus minos** Osten Sacken, 1877, West. Dipt., p. 291. Holotype from Golden. Ft. Collins, Aug. 10, 1937 (James) and Sept. 23; Grand Junction, July 3, 1932 (L. G. Davis); Cortez, July 20, 1933 (K. Maehler); Allison, July 27, 1936 (Rotger).

MICROSTYLUM Macquart

Bromley, 1934, Ann. Ent. Soc. Amer., 28: 81.

36. **Microstylum galactodes** Loew, 1866, Cent., VIII, 44. Las Animas, July 12, 1931 (Leonard Sweetman).

LAPHYSTIA Loew.

Curran, 1931, Amer. Mus. Nov., 487, pp. 10-19.

37. **Laphystia limatula** Coquillett, 1904, Proc. Ent. Soc. Wash., 6: 180. Arboles, 6000', July 4, 1938 (Rotger); La Posta, June 22, 1936 (Rotger); det. Bromley.

38. **Laphystia rufiventris** Curran, 1931, Amer. Mus. Nov., 487 p. 17. 1 female, 5 miles north of Delta, June 30, 1938 (R. Bauer). Originally described from a single greased female from Green River, Wyo. The present specimen has the head, thorax and the sides of abdominal segments 1 to 6 densely grayish pollinose; on the abdomen, the pollen extends inward in the form of triangles on the posterior parts of the segments, but the triangles of each segment are separated from each other by fully half the width of the abdomen, and there is no indication that they may join to form cross-bands. Some pile on the abdomen is black.

39. **Laphystia lanhami**, n. sp. **Male.** Head black in ground color, wholly covered with dense whitish pollen; pile abundant, particularly on the face and lower part of the occiput, wholly white; mystax white. Front deeply incised. Antennae black, white pilose and whitish (or light grayish) pollinose; the conspicuous bristles at the apex of the first segment yellowish; the ratio of the three antennal segments and the style 5:5:10:2 the style about as long as broad. Thorax black, densely pollinose; the appressed pile and pollen on the dorsum on the upper part of the mesopleura with a distinct yellowish cast, on the other parts of the thorax whitish; bristles of the dorsum yellow, pile and bristles otherwise white; dorsum without noticeable erect pile. Coxae black, densely white pollinose; trochanters black,

shining except for the apices of the posterior pair. Front femora black, except the narrow apices and the basal part (extreme base only above, about the basal fourth below), which are reddish yellow; middle femora reddish yellow, blackened on the apical third to half above, the black sometimes forming a more or less indistinct complete ring apically: hind femora reddish yellow, blackened above except at extreme base, sometimes blackish below at apex; the black areas noticeably whitish pollinose. Tibiae black, the bases reddish yellow; tarsi black. Pile and bristles of legs white. Wings hyline, with a slightly brownish tinge; veins brownish yellow, more yellowish toward base. Halteres reddish-yellow. Abdomen black, the sides of the dorsum with dense white pollen which expands above the posterior margins of the segments and forms apical cross bands on the seventh, usually on the second and third, and sometimes on other segments. Venter wholly whitish pollinose. Genitalia black. Length, 8.5-10 mm.

Female. Similar to the male, except sexually. The broader abdomen has the pollinose bands more uniform; in the specimens before me, they are complete on segments two, three, four, and seven.

Holotype, male, Delta, Colo., June 27, 1938 (R. Bauer); **Allotype**, female, Delta, Colo., July 3, 1938 (U. Lanham); **Paratopotypes**, 10 males, 7 females, Delta, Colo., June 25, July 3, and July 5, 1938. (Lanham, Bauer).

The coloration of the legs is different from that of any other species known to me. In Curran's key, it does not run satisfactorily beyond couplet 2, since the posterior femora are reddish on the basal half below but on less than the basal third above. If we choose either alternative and try to run it further in the key, we get into difficulties because of the variability of the abdominal bands (at least in the male). In one male of my series, there is no trace of a complete band on any segment but the second, whereas in another male specimen only the sixth segment lacks the complete band.

PSILOCURUS Loew

Curran, 1931, Amer. Mus. Nov., 487, pp. 8-10.

40. **Psilocurus nudiusculus** Loew, 1874, Berl. Ent. Zeit., 18: 370. Cheyenne Wells, July 27, 1933 (Rodeck & James).

DIOCTRIA Meigen

Melander, 1923, Psyche, 30: 212-216.

41. **Dioctria pusio** Osten Sacken, 1877, West. Dipt. p. 288. Recorded from Colo, without locality, by Williston.

DICOLONUS Loew

42. **Dicolonus sparsipilosum** Back, 1909, Trans. Amer. Ent. Soc., 35: 247. Cotype from Colorado, without citation of locality. Seven miles south of Glade Park, June 23, 1938. (Lunham and Bauer).

(To be concluded in the April issue)

REPRINT PRICES

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

Pages	1-2	3-4	5-8	9-12	13-16	17-20	21-24	25-28
50 copies	$1.10	$1.40	$3.85	$5.25	$7.45	$ 9.65	$11.85	$14.05
100 copies	1.40	1.65	4.15	5.80	8.00	10.20	12.40	14.60
200 copies	1.65	2.20	4.95	7.15	9.35	11.55	13.75	15.95
100 Add'n'l	0.55	1.10	2.20	3.30	4.40	5.50	6.60	7.70

Tables—for setting up—$1.25 per page extra.

Covers, per 100—$2.50

Fifty copies of reprints are free to the authors provided at least 50 copies are purchased. Reprints should be ordered in lots of 50 or multiples thereof.

Postage or express charges on carriage of reprints are extra

PRICE OF BACK VOLUMES

Volume 1 .... $2.00
Volumes 2 to 7 inclusive 1.00
Volumes 8 to date 1.50

Subscriptions for back volumes or numbers should be sent to the Secretary-Treasurer, Entomology Department, Kansas State College, Manhattan, Kansas.

CONTENTS OF THIS NUMBER

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

A quarterly journal published in January, April, July and October devoted to Entomology in the Western Mississippi Basin and the proceedings of the Kansas Entomological Society.

Manuscripts for publication may be sent to any of the publication committee.

The Kansas Entomological Society does not make exchanges since the Society does not maintain a library.

Subscription to the Journal must be paid in advance. The subscription rate is so low that second notices are not ordinarily sent out.

Payment of Canadian or other foreign subscriptions and bills must be made by international Postal Money Order or by a draft on a New York bank and payable in U. S. A. dollars.

Subscribers are urged to give us their full cooperation in these matters.

Subscriptions should be sent to the Secretary-Treasurer, Entomology Department, Kansas State College, Manhattan, Kansas.

Subscriptions in the U. S. A.,	**$1.50 per year**	**Single Copy**
Canadian or foreign subscriptions,	**1.75 per year**	**60 cents**

KANSAS ENTOMOLOGICAL SOCIETY

President, R. L. Parker, Manhattan
Vice-President, Don B. Whelan, Lincoln, Nebraska
Secretary-Treasurer, Donald A. Wilbur, Manhattan

Volume 14, No. 1, January, 1941

VOL. 14 APRIL, 1941 NO. 2

Journal

OF THE

Kansas Entomological Society

PUBLICATION COMMITTEE
PAUL B. LAWSON, Editor, Lawrence
R. H. BEAMER, Lawrence R. H. PAINTER, Manhattan
DWIGHT ISELY, Fayetteville, Ark.

JAMES WALKER McCOLLOCH
1889-1929

Entered as second-class matter June 7, 1939 at the Post Office at Manhattan, Kansas, under the Act of August 24, 1912

Kansas Entomological Society

Volume 14 | **April, 1941** | **Number 2**

THE ROBBER FLIES OF COLORADO (Diptera, Asilidae)

MAURICE T. JAMES, Colorado State College

(Continued from the January Issue)

STICHOPOGON Loew

Wilcox, 1936, Pan-Pac. Ent., 12: 207-211.

43. **Stichopogon argenteus** (Say), 1822, Jour. Acad. Sci. Philad., 3:51. Roggen, Aug. 29, 1930 (Rodeck) and Sept. 8, 1932 (James); Sand Dunes, Alamosa, Aug 11, 1934 (James).

44. **Stichopogon abdominalis** Back, 1909, Trans. Amer. Ent. Soc., 35:332. Roggen, July 8, 1933 (M. & H. James, Louise Ireland) and July 6 to 7, 1937 (James and Moss).

45. **Stichopogon trifasciatus** (Say) 1822, Jour. Acad. Sci. Philad., 3: 51. Recorded from Manitou by Tucker and from Boulder by Cockerell. Common on the eastern Colorado plains: Boulder; Owen's Lake, near Boulder; Valmont; White Rocks, near Valmont; Ft. Collins; Roggen; Denver; Burlington; Chivington; Two Buttes Reservoir; Lamport; Hoehne; Colorado. north of Ramsey, Okla. July to Sept.

LASIOPOGON Loew

Cole and Wilcox, 1938, Ent. Amer., 18 (n. s.): 1-91.

46. **Lasiopogon oklahomensis** Cole & Wilcox, 1938, Ent. Amer., 18 (n. s.): 57. Arboles, May 22, 1936 (Rotger), det. Bromley.

47. **Lasiopogon fumipennis** Melander, 1923, Psyche, 5: 141. Ward, June 2-9, 1933 (H. G. & H. E. Rodeck); South St. Vrain, near Lyons, June 9, 1933 (Helene Gibbons); Park Co., 9500 ft., June 17, 1938 (Rotger); Glade Park, June 23, 1938 (Lanham).

48. **Lasiopogon aldrichii** Melander, 1923, Psyche, 5: 139. Grand Mesa, July 8 & 10, 1938 (Lanham and Bauer).

49. **Lasiopogon opaculus** Loew, 1874, Berl. Ent. Zeit., 18: 367. Recorded by Back from La Veta Pass.

COLEOMYIA Wilcox & Martin

Wilcox & Martin, 1935, Bul. Brooklyn Ent. Soc., 30: 204-213.

50. **Coleomyia alticola,** n. sp.

Male. Head wholly black, covered with a whitish pollen; bristles of face, front, vertex, occiput, and antennae black; pile practically lacking, except on the lower part of the occiput, where it becomes white and more or less bushy. Proboscis, palpi, and antennae black. First and second antennal segments equal, third slightly longer than the first two together; style slightly longer than broad, and terminating in a minute bristle; first segment with two, second with one, strong bristle below. The illustration of **C. sculleni** in Wilcox and

Martin, l. c., p. 212, will serve for this species. Thorax black, entirely whitish pollinose except for a double narrow brown stripe on the middle of the dorsum and a broader one of like color, abbreviated at each end and interrupted at the suture, on each side. Bristles black; two small humerals, one post humeral, two presuturals, one supra-alar, one post-alar, four to five dorsocentral, two scutellars, and one to three hypopleurals, all except the humerals strong. Scutellum whitish pollinose. Legs black with black bristles, at most a suggestion of reddish at the apices of the femora and tibiae; coxae whitish pollinose, legs otherwise shining; pile sparse, black, that on the underside of the front and middle tarsi becoming yellowish to reddish. Wings anterior to base of discal cell milky white, with yellow veins; otherwise grayish with dark brown to blackish veins. Halteres lemon-yellow, brown at base of stalk. Abdomen black; the first segment whitish pollinose on the sides; the second to sixth each with a small whitish pollinose wedge-shaped marking at each posterior angle; venter whitish pollinose on the first segment, and on the bases and apical halves of the second to sixth inclusively; apical segments and genitalia black. First segment with a group of yellow bristles on each side. Length, 6 - 7.5 mm.

Female. Similar to male. Only one bristle on underside of first antennal segment. Dorsum of thorax more extensively brownish pollinose, the separation of the two median lines being indistinct. Wings uniformly grayish, with brown veins. Sixth and seventh segments of abdomen wholly shining; ventral segments two to four pollinose only at apices, five wholly shining. Bristles on sides of segment one in some specimens black above.

Holotype, male, Science Lodge, near Ward, Colo., July 24, 1939 (Lanham). **Allotype**, female, same data. **Paratopotypes**, 4 males, 2 females, Science Lodge, July 24, Aug. 2, and Aug. 17 (Lanham) and 1 female, Aug. 14 (James). **Paratypes**, 2 females, Pingree Park, Colo., Aug. 14-19, 1933 (M. & H. James).

In the Wilcox and Martin key, the males run to **setiger**, except that the lateral bristles of the first abdominal segment are yellow instead of white, and the hypopleurals are one to three in number. The females run to **rainieri**, but the scutellum is entirely pollinose and the lateral bristles of the first abdominal segment yellow.

WILCOXIA, new genus

Small Asilidae, of somewhat dubious relationship. In Curran's key (Families and Genera of North American Diptera), this genus traces to **Chrysoceria**; instead of the middle tibiae terminating in a pair of strong divergent bristles, as in **Chrysoceria** and **Callinicus**, however, they terminate in a single strong straight spine. In habitus, **Wilcoxia** resembles **Chrysoceria**, but specimens are much smaller and black. Readily distinguished from **Buckellia** and **Cophura**, to

which it is related, by the absence of the apical crooked spine on the anterior tibiae. Type, **W. cinerea**, new species.

Named in honor of Dr. Joseph Wilcox.

51. **Wilcoxia cinerea**, new species

A small, black, densely cinereous-pollinose species, with the wings of the male clouded with black.

Male. Head black, the background entirely concealed by cinereous pollen; proboscis, palpi, and antennae black; pile and bristles of the head entirely white. First antenral segment slightly longer than the second, the third three times the length of the first; the style short, sharp, and ending in a small bristle. Thorax black, with cinereous pollen, pile, and bristles; the dorsum, before the suture, with two median black stripes; a rounded area of brownish pollen to each side of these, just before the suture; the scutellum with its extreme apex polished, and with four marginal bristles. Coxae black, the ground color completely obscured by cinereous pollen; femora and tarsi black, shining; tibiae shining, black, except the basal fourth of the fore and middle tibiae and the basal half of the posterior ones, which are bright yellow; pile and bristles wholly whitish, except on the inner surfaces of the tarsi and of the front and hind tibiae, where it is dense and yellowish. Hind tarsi enlarged apically, clavate in outline. Wings infumated with brown, except apically, the infumation being strongest near the veins. Venation typ cal; cross-vein r-m at about 4/7 the length of the discal cell; the origin of R_4 almost opposite the apex of the discal cell. Abdomen shining black, bluish in some lights, the lateral margins and venter, however, obscured by cinereous pollen, the pollinose areas of the lateral margins being broader posteriorly on the segments; genitalia shining. Pile entirely white. Length, 6.5 mm.

Female. The pollen, pile, and bristles are somewhat more yellowish; the yellow of the legs more extensive, the apices of the fore and hind femora, and all but the apices of the corresponding tibiae, being yellow; the middle tibiae are about half yellow; the black stripes of the thoracic dorsum are less evident and the wings are but very slightly infumated, almost hyaline. Length, 7 mm. Otherwise as in the male.

Holotype, male, near Saguache, Colo., Aug. 7, 1937 (R. H. Painter); Painter Collection. **Allotype**, female, same data. **Paratopotypes**, male, female, same data.

EUCYRTOPOGON Curran

Curran, 1923, Canad. Ent., 55: 95, 116-122.

52. **Eucyrtopogon comantis** Curran, 1923, Canad. Ent., 55: 116. Denver, Oct. 12, 1933 (Albert Milzer); Pagosa Springs, Sept. 16, 1935 (Rotger).

53. **Eucyrtopogon diversipilosis** Curran, 1923, Canad. Ent., 55: 118. Antonito, Nov. 30, 1936 (Rotger), det. Bromley; Grand Mesa, July 7 and 10, 1938 (Bauer & Lanham).

CYRTOPOGON Loew

Wilcox & Martin, 1936, Ent. Amer., 16 (n. s.): 1 95.

54. **Cyrtopogon pulcher** Back, 1909, Trans. Amer. Ent. Soc., 35: 274. Holotype from Palmer Lake. Recorded by Wilcox and Martin from Long's Peak Inn, Boulder, Horseshoe Park, and Roan Mts. Nederland, July 9, 1932 (James); Sprague Hotel, Rocky Mt. National Park, July 5, 1933 (Helen Rodeck); Custer Co., 9000 ft., Aug. 11, 1928 (R. H. Painter); 7 miles south of Glade Park, June 23, 1938 (Lanham).

55. **Cyrtopogon glarealis** Melander, 1923, Psyche, 30: 113. La Plata Co., 8500 ft., Aug. 1, 1938 (Rotger); La Plata Mts., 10,000 ft., July, 1938 (Rotger); Front Range, 11,000 ft., near Echo Lake, July 22, 1937 (Rotger); det. Bromley.

56. **Cyrtopogon dasyllis** Williston, 1893, Kans. Univ. Quart., 2: 66. Holotype from top of Deer Mt., Aug. (F. H. Snow).

57. **Cyrtopogon callipedilus** Loew, 1874, Berl. Ent. Zeit., 18: 358. Recorded by Melander from Colo.; Wilcox and Martin question this record.

58. **Cyrtopogon plausor** Osten Sacken, 1877, West Dipt., p. 297. Recorded by Cockerell from Boulder and Florissant, and by Wilcox and Martin from A. S. U. C. Lodge, near Boulder; Moraine Park, Sprague Hotel, Sheeps Lake, and Beaver Brook, Rocky Mountain National Park; Creede; Florissant; Glendevey; Gold Hill; Manitou; and Platte Canyon, near Idlewild. Very common in the mountains: Boulder; Glacier Lake, Boulder Co.; Central City; Nederland; Clear Creek Co.; Horsetooth Mountain, near Ft. Collins; Turkey Creek, Morrison; Avon; Black Mesa; Tolland; Lee Hill, near Boulder; Gothic; Lake City; Ward; and Park Co. June to Aug.

59. **Cyrtopogon praepes** Williston, 1884, Trans. Amer. Ent. Soc., 11: 12. Recorded from Colorado by Curran.

60. **Cyrtopogon willistoni** Curran, 1922, Canad. Ent., 54: 277. Evergreen, July 15, 1937 (Rotger); Coal Creek, near Golden, June 14, 1938 (Rotger); det. Bromley. Fifteen males and eight females, 7 miles south of Glade Park, June 19-23, 1938, and one male, Grand Mesa, June 18, 1938 (Lanham & Bauer) are intermediate between **willistoni** and **plausor**.

61. **Cyrtopogon bimacula** Walker, 1851, Dipt. Saund., II, p. 102. Recorded from Colorado, without locality, by Back, and from Camp Creek R. Sta., Aspen, South Peak, and Ward by Wilcox and Martin. Trail Ridge Road, Rocky Mountain National Park, 11,000 ft., Aug. 25, 1933 (M & H. James); Longs Peak, July 4, 1920 (M. Dings);

Gothic, June 17 and 29, 1929 (E. C. Nelson) and June 26, 1932 (F. B. Isely); La Plata Mts., 10,500 ft., July 6, 1938 (Rotger); Grand Mesa, July 8 and 10, 1938 (Lanham).

62. **Cyrotopogon montanus** Loew, 1874, Berl. Ent. Zeit., 18: 362. **C. leucozona** Loew is a light-haired variant female of **C. montanus.** Recorded by Wilcox and Martin from A. S. U. C. Lodge, near Boulder; Gold Hill; Long's Peak Inn; Poncha Pass; Moraine Park, Rocky Mountain National Park; Ward; and Tennessee Pass, the last three records as **montanus**. Common: Muskee Lake, near Nederland; Pine Cliff; Estes Park; Edwards; Lonetree; Glacier Lake, Boulder Co.; Lump Gulch near Gilpin; Hesperus; San Juan Co.; Florida; Denver; Meeker; Grand Mesa; Glade Park. May to July.

63. **Cyrtopogon jemezi** Wilcox & Martin, Ent. Amer., 16 (n. s.): 47, 1936. Larimer Co. Foothills, June 26, 1915 (M. A. Palmer).

64. **Cyrtopogon inversus** Curran, 1923, Canad. Ent., 55: 172. Recorded from Long's Peak by Wilcox and Martin.

65. **Cyrtopogon rufotarsus** Back, 1909, Trans. Amer. Ent Soc., 35: 275. Recorded from Ward by Wilcox and Martin.

66 **Cyrtopogon profusus** Osten Sacken. 1877, West. Dipt. p. 305. Recorded by Tucker from Manitou and by Wilcox and Martin from Estes Park, Telluride, and Custer Co. Common in the Mountains. Boulder; A. S. U. C. Lodge, near Boulder; Science Lodge; Horsetooth Mountain, Larimer Co.; Hesperus; Saguache; Twin Lakes. July, Aug.

67. **Cyrtopogon ablautoides** Melander, 1923, Psyche, 30: 111 Maybell, June 17, 1907.

68 **Cyrtopogon idahoensis** Wilcox and Martin, 1936, Ent. Amer., 16 (n s.): 82. Hesperus, July 3, 1935 (Rotger).

69. **Cyrtopogon rejectus** Osten Sacken, 1877, West. Dipt., p 307. Pagosa Junction, July 2, 1938 (Rotger), det. Bromley.

70. **Cyrtopogon banksi** Wilcox and Martin, 1936, Ent. Amer., 16 (n. s.): 79. Paratypes from Roan Mts., above Ute Trail, and from Aspen. Boulder, July 13, 1935; Horsetooth Mountain, Larimer Co., July 17, 1935 (James & Hoerner); 7 miles South of Glade Park, June 19-23, 1938 (Bauer & Lanham).

HOLOPOGON Loew

Key to species found in Colorado

1. Wings for the most part blackened or deep black --- **atripennis**
   Wings hyaline ---------- 2
2. Pile of entire body white, or at most some black pile on the vertex ---------- 3
   Some pile on the head, thorax, legs, and usually abdomen black ---------- **guttula**
3. Pile of thoracic dorsum bushy, as long as the halteres; some bushy pile on head; wing veins light yellow - **seniculus**

Pile of thorax and head shorter and not bushy; wing veins in large part darkened .... **albipilosus**

71. **Holopogon atripennis** Back, 1909, Trans. Amer. Ent. Soc., 35: 312. Common in grassland, foothills and mountains: Boulder; Red Rocks Park, Morrison; Virginia Dale; Poudre Canyon; Beaver Point, Rocky Mountain National Park; Ward; Mishawauka, Larimer Co.; Spring Canyon, near Ft. Collins; Custer Co.; Lake City; Lonetree. June in the foothills, July to Aug. in the higher mountains.

72. **Holopogon guttula** Wiedemann, 1821, Dipt. Exot., p. 228. Recorded by Back from Colorado. Saguache, Aug. 4, 1937 (R. H. Painter).

73. **Holopogon seniculus** Loew, 1866, Cent., VII, 62. Roggen, May 18 to July 31; La Porte, July 22, 1935 (James). Specimens from Eckert, June 20, 1938 (Lanham) and Delta, June 27, 1938 (Lanham) are intergrades between this species and **albipilosus.**

74. **Holopogon albipilosus** Curran, 1923, Canad. Ent., 55: 207. Delta, June 25 and 28, 1938 (Lanham); McCoy, July 13, 1938 (Bauer); Eckert, June 28, 1938 (Lanham).

HETEROPOGON Loew.

Key to species found in Colorado*

1. Abdomen with the posterior one-third of the segments clothed with long recumbent light hair .... **johnsoni**
   Abdomen dorsally with very short inconspicuous hairs 2
2. Scutellum without marginal bristles; wings with distinct small brown cloud on the cross-vens and furcations .... **maculinervis**
   Scutellum with marginal bristles; wings hyaline or with only faint clouds 3
3. Abdomen entirely bare of pollen .... **senilis**
   Entire male abdomen and segments 1-5 of female abdomen whitish pollinose .... **wilcoxi**

75. **Heteropogon johnsoni** (Back), 1904, Canad. Ent., 36: 293. Type from Ft. Collins. Ft. Collins, Sept. 5 and 22, 1932.

76. **Heteropogon maculinervis** James, 1937, Ent. News, 48: 12. Holotype from Masonville; paratypes from Huerfano Co. and Eagle. Boulder, Sept. 8, 1932 (H. W. Campbell); Allison, July 29, 1935 (Rotger).

77. **Heteropogon senilis** Bigot, 1878, Am. Soc. Ent. Fr., (5) 10: 423. Recorded from Colorado by Back. Durango, Aug. 2, 1936 (Rotger), det. Bromley.

78. **Heteropogon wilcoxi** James, 1934, Pan-Pac. Ent., 10: 84. Holotype from Mesa de Mayo, near Tobe; paratypes from Model. Ft. Collins, June and July (James); 4 miles south of Hygiene, Aug.

*Adapted from a manuscript key sent to me by Dr. Joseph Wilcox.

1, 1935 (Lanham).

ASILUS Linnaeus

Key to species found in Colorado

1. Abdomen on each side near incisures with a row of bristles which are clearly longer than the hairs to be seen on other parts of the segments ------ ------------ 2
   Abdomen on each side near the incisures with only the ordinary hairs; body black; space between the antennae and the facial gibbosity shining black **nitidifacies**
2. Scutellum without bristles ------------ ------ ------- **belli**
   Scutellum with two or more marginal bristles --- -------- 3
3. Middle and hind femora black to apex ------------------ 4
   Femora with at least apices or under side red or reddish - -- 6
4. Scutellum with four or more marginal bristles; wings glossy hyaline; male genitalia notched at tip; tibiae in large part bright yellow; larger species, 12 mm. or more ------------ - ------- -- ----- - ------ **orphne**
   Scutellum with two bristles; male genitalia not notched; tibiae in part yellow, but the color not conspicuously bright; smaller species, less than 10 mm --------------- 5
5. Yellowish gray species; mystax wholly pale; arista broad, not clearly differentiated from its segment ---- **mesae**
   Black species; mystax black above; arista clearly separated from its segment -------- -- -- ----------- **vescus**
6. From dorsal view, male forceps wider at two-thirds their length than at base; first segment of ovipositor, that is, the eighth abdominal segment, longer than the sixth and seventh combined ----------------- -- **lepidus**
   From dorsal view male forceps gradually narrowed from near the base to the apex; first segment of ovipositor of normal length -------------------- --- ----------- 7
7. Golden yellow species; femora, tibiae, mystax, and hairs and bristles of abdomen golden ----------------- **gilvipes**
   Black or gray or yellowish, not golden species; femora at least in part black ------------------------- ------ 8
8. Femora yellow, blackened only on the median half of the anterior surface; tibiae yellow, at most slightly darkened apically ---- ------------------------ **formosus**
   Femora and tibiae more extensively black --------------- - 9
9. Arista about as long as the third segment; only two bristles on the front side of the hind tibiae in addition to the apical ones ---------------- ---------- -- 10
   Arista usually not more than two-thirds as long as the third segment; three bristles on the front side of the

Pile of thorax and head shorter and not bushy; wing veins in large part darkened ---------------- **albipilosus**

71. **Holopogon atripennis** Back, 1909, Trans. Amer. Ent. Soc., 35: 312. Common in grassland, foothills and mountains: Boulder; Red Rocks Park, Morrison; Virginia Dale; Poudre Canyon; Beaver Point, Rocky Mountain National Park; Ward; Mishawauka, Larimer Co.; Spring Canyon, near Ft. Collins; Custer Co.; Lake City; Lonetree. June in the foothills, July to Aug. in the higher mountains.

72. **Holopogon guttula** Wiedemann, 1821, Dipt. Exot., p. 228. Recorded by Back from Colorado. Saguache, Aug. 4, 1937 (R. H. Painter).

73. **Holopogon seniculus** Loew, 1866, Cent., VII, 62. Roggen, May 18 to July 31; La Porte, July 22, 1935 (James). Specimens from Eckert, June 20, 1938 (Lanham) and Delta, June 27, 1938 (Lanham) are intergrades between this species and **albipilosus.**

74. **Holopogon albipilosus** Curran, 1923, Canad. Ent., 55: 207. Delta, June 25 and 28, 1938 (Lanham); McCoy, July 13, 1938 (Bauer); Eckert, June 28, 1938 (Lanham).

HETEROPOGON Loew.

Key to species found in Colorado*

1. Abdomen with the posterior one-third of the segments clothed with long recumbent light hair ------------ **johnsoni**
   Abdomen dorsally with very short inconspicuous hairs ------- 2
2. Scutellum without marginal bristles; wings with distinct small brown cloud on the cross-vens and furcations --- **maculinervis**
   Scutellum with marginal bristles; wings hyaline or with only faint clouds ------------------------------------ 3
3. Abdomen entirely bare of pollen ------------------- **senilis**
   Entire male abdomen and segments 1-5 of female abdomen whitish pollinose -------------------------- **wilcoxi**

75. **Heteropogon johnsoni** (Back), 1904, Canad. Ent., 36· 293. Type from Ft. Collins. Ft. Collins, Sept. 5 and 22, 1932.

76. **Heteropogon maculinervis** James, 1937, Ent. News, 48: 12. Holotype from Masonville; paratypes from Huerfano Co. and Eagle. Boulder, Sept. 8, 1932 (H. W. Campbell); Allison, July 29, 1935 (Rotger).

77. **Heteropogon senilis** Bigot, 1878, Am. Soc. Ent. Fr., (5) 10: 423. Recorded from Colorado by Back. Durango, Aug. 2, 1936 (Rotger), det. Bromley.

78. **Heteropogon wilcoxi** James, 1934, Pan-Pac. Ent., 10: 84. Holotype from Mesa de Mayo, near Tobe; paratypes from Model. Ft. Collins, June and July (James); 4 miles south of Hygiene, Aug.

*Adapted from a manuscript key sent to me by Dr. Joseph Wilcox.

1, 1935 (Lanham).

ASILUS Linnaeus

Key to species found in Colorado

1. Abdomen on each side near incisures with a row of bristles which are clearly longer than the hairs to be seen on other parts of the segments ---- --------------- 2
   Abdomen on each side near the incisures with only the ordinary hairs; body black; space between the antennae and the facial gibbosity shining black-- **nitidifacies**
2. Scutellum without bristles ---------------------- ------ **belli**
   Scutellum with two or more marginal bristles -------------- 3
3. Middle and hind femora black to apex ------------------- 4
   Femora with at least apices or under side red or reddish ---- 6
4. Scutellum with four or more marginal bristles; wings glossy hyaline; male genitalia notched at tip; tibiae in large part bright yellow; larger species, 12 mm. or more --------------------- ----------------- **orphne**
   Scutellum with two bristles; male genitalia not notched; tibiae in part yellow, but the color not conspicuously bright; smaller species, less than 10 mm. --------------- 5
5. Yellowish gray species; mystax wholly pale; arista broad, not clearly differentiated from its segment ---- **mesae**
   Black species; mystax black above; arista clearly separated from its segment ---------------------------- **vescus**
6. From dorsal view, male forceps wider at two-thirds their length than at base; first segment of ovipositor, that is, the eighth abdominal segment, longer than the sixth and seventh combined ---------------------- **lepidus**
   From dorsal view male forceps gradually narrowed from near the base to the apex; first segment of ovipositor of normal length ------------------------- ---------- 7
7. Golden yellow species; femora, tibiae, mystax, and hairs and bristles of abdomen golden -------------------- **gilvipes**
   Black or gray or yellowish, not golden species; femora at least in part black ---------------------------------- 8
8. Femora yellow, blackened only on the median half of the anterior surface; tibiae yellow, at most slightly darkened apically ------------------------------ **formosus**
   Femora and tibiae more extensively black ------------------ 9
9. Arista about as long as the third segment; only two bristles on the front side of the hind tibiae in addition to the apical ones ---------------------------------- 10
   Arista usually not more than two-thirds as long as the third segment; three bristles on the front side of the

hind tibiae 12

10. Gray of wings in the form of spots in the cells at the apex and along the posterior margin, the veins being margined with hyaline .... **tenebrosus**

Apex and posterior border uniformly gray or subhyaline 11

11. Posterior margin of the eighth abdominal segment of the male produced ventrally .... **avidus**

Eighth abdominal segment not so produced .... **callidus**

12. Each femur with the posterior side and preapical band red or yellow 14

Each femur with only the preapical band red 13

13. Bristles of the under side of each front femur rather stout, nearly always at least partly black; upper forceps of male genitalia, from side view, of the same thickness throughout .... **paropus**

Bristles on the under side of each front femur rather weak; upper forceps of male genitalia, from side view, widest at two-thirds their length .... **erythrocnemius**

14. Bright gray or yellowish species; post-occipital bristles entirely yellow or white; mystax with at most a few black hairs above .... **prairiensis**

Dull gray species; the anterior femur with gray hairs below; post-occipital bristles black above; mystax with a number of black bristles above .... **delusus**

79. **Asilus nitidifacies** Hine, 1908, Canad. Ent., 40: 202. Pingree Park, Aug. 17, 1932 (James) and Aug. 14-19, 1933 (M. & H. James).

80. **Asilus belli** (Curran).

Negasilus belli Curran, 1934, N. Amer. Dipt., p. 184.

Male and Female. Black, grayish-pollinose; antennae black, the first and second segments with short black hairs, the style thick especially basally; mystax white, a few black bristles above. Thorax mostly with white but with a few black bristles. Legs black; an apical ring on each femur, the fore and middle tibiae for most of their extent and the posterior ones less so, the basitarsi completely or in large part, and sometimes parts of other tarsal segments, red; the femora not especially hairy; the anterior femora each with three or four short, stubby, white bristles below. Abdomen white-haired. Length, 9-10 mm. Distribution, Oregon to Nevada and Colorado.

COLORADO RECORDS. Roggen, June 16, 1936 (M. T. James) and July 6 and 7, 1937 (M. T. James, C. H. Moss); Mountain Home Lake, Fort Garland, July 20-25, 1932; Fort Collins, June 28, 1937 (James); Costilla Co., July 19, 1932; Saguache, Aug. 7, 1937 (R. H. Painter).

Closely related to **A. mesae,** which species it resembles in size and color; the structure of the antennae is the same, the style being broad at the base and not very distinctly separated from the rest of the third antennal segment; the male forceps are similar in structure and light reddish in color. The femora, however, are black, each with an apical ring red, and not especially hairy; the wings are much broader and distinctly clouded with light brown at the apex and in the cells along the posterior margin, and **the scutellum lacks any trace of marginal bristles.** This last character distinguishes this species from all other **Asilus** known to me, except that I have an otherwise typical **A. mesae** which shows this character.

The types, Dr. Curran tells me in correspondence, were taken by E. L. Bell at Fallon, Nevada, June 14. To my knowledge, no complete description of this species has been published previously.

81. **Asilus orphne** Walker, 1849, List, 2, p. 456. Avon, July 14, 1932.

82. **Asilus mesae** Tucker, 1907, Kans. Univ. Sci. Bul., 4: 92 Types from Colorado Springs. Common and widespread: Lonetree; Allison; Hesperus; Juanita; Pagosa Springs; Costilla Co.; Mountains Home Lake, Ft. Garland; Cassells; Gunnison; Alamosa Co.; Boulder; Ft. Collins; Roggen; Ordway; Masonville. June to late Sept.

83. **Asilus vescus** Hine, 1918, Ohio Nat., 18: 320. Science Lodge, Boulder Co., July 27, 1939 (Lanham) and Aug. 15, 1939 (Lois McCaskey); Wondervu, Jefferson Co., July 28, 1939 (Lanham); Rand, Aug. 26, 1940 (H. C. Severin).

84. **Asilus lepidus** Hine, 1909, Ann. Ent. Soc. Amer., 2: 150. Male types (holotype?) from Colorado.

85. **Asilus gilvipes** Hine, 1918, Ohio Nat., 18: 319. Type from Saguache. Salida, June 20, 1933 (Chas. H. Wagner).

86. **Asilus formosus** Hine, 1918, Ohio Nat., 18: 321. Common at entrances to prairie dog holes, where one Asilid would be found guarding each hole. Ft. Garland, Aug. 5, 1938 (James & Lanham); Ft. Collins, July 13, 1939 (James); Delta, June 25, 1938 (Lanham); Allison, July, 1938 (Rotger).

87. **Asilus tenebrosus** Williston, 1900, Biologia, Dipt., I, p. 328. Recorded by Tucker from Colorado Springs. Widespread in mountain canyons: Pagosa Junction; Rockwood, La Plata Co.; La Veta Pass; Boulder Canyon; Masonville; Home; Estes Park; Jamestown. June to Aug.

88. **Asilus avidus** Van der Wulp, 1869, Tijdschr. V. Ent., Sect. XII, p. 82. Recorded by Cockerell from Copeland Park and North Boulder Creek. Widespread in the mountains; Pagosa Springs; Hesperus; Francis; Lonetree; San Luis Lakes; Steamboat Springs; Garfield Co.; Beulah; Custer Co.; Home; Virginia Dale; Estes Park;

Ft. Collins; Glendevey; Boulder; A.S.U.C. Lodge, near Boulder; Nederland. June to early Sept.

89. **Asilus callidus** Williston, 1893, Kans. Univ. Quart., 2: 75. In the mountains: La Plata; Arboles; Saguache; Cedaredge; Peaceful Valley; Steamboat Springs; Boulder; Science Lodge. June to Aug.

90. **Asilus paropus** Walker, 1849, List, II, p. 455. Recorded by Cockerell from Boulder. Common locally: Ft. Collins; Roggen; Boulder; Glendevey; Steamboat Springs; Lonetree; Delta. June to Sept.

91. **Asilus erythrocnemius** Hine, 1909, Ann. Ent. Soc. Amer., 2: 163. Common: Boulder; Ft. Collins; McClelland's, south of Ft. Collins; Pine Cliffe; Crowley; Manzanola; Hoehne; Costilla Co.; Delta. July to early September.

92. **Asilus prairiensis** Tucker, 1907, Kans. Univ. Sci. Bul., 4: 92. Types from Colorado Springs. Common and widespread: Boulder; Pingree Park; Ft. Collins; Roggen; Nederland; Longmont; Denver: Valmont; Platteville; Crowley; Ordway; Manzanola; Hoehne; Las Animas; Canon City; Model; Alamosa Co.; Arboles; Francis. Late July, Aug., early Sept.

93. **Asilus delusus** Tucker, 1907. Kans. Univ. Sci. Bul., 4: 92. Types from Colorado Springs. Hayden, July 29, 1904; Misawauka, Poudre Canyon, Larimer Co., July 11, 1937 (James); Custer Co., Aug. 11, 1928 (Painter).

PHILONICUS Loew.

Bromley, 1934, Ann. Ent. Soc. Amer., 27: 87.

94. **Philonicus limpidipennis** Hine, 1909, Ann. Ent. Soc. Amer., 2: 167. Types from "Southwestern Colorado." Arboles, June 21, 1935 (Rotger); Ft. Collins, on bare sand along the Poudre River, July 10-30, 1935 (James).

PROMACHUS Loew.

Hine, 1911, Ann. Ent. Soc. Amer., 4: 164-172.*

95. **Promachus nigripes** Hine, 1911, Ann. Ent. Soc. Amer., 4: 170. Recorded by C. J. D. Brown from Mesa Verde National Park. Saguache, Aug. 13, 1937 (R. H. Painter).

96. **Promachus albifacies** Williston, 1885, Trans. Amer. Ent. Soc., 12: 63. Common, foothills and mountains: Boulder; A.S.U.C. Lodge, near Boulder; Horsetooth Mountain, Larimer Co.; Lee Hill, near Boulder; White Rocks, near Valmont; Ft. Collins; Red Rocks Park; La Porte; Las Animas; Canon City; Glade Park; Durango. June to Aug.

97. **Promachus bastardii** Macquart, 1838, Dipt. Exot., I, 2, p.

*In Hine's key, **oklahomensis** Prichard will run to **fitchii** O. S. **Oklahomensis** is grayish, **fitchii** yellow-pilose and pollinose.

104. Sterling, July 22, 1931 (C. R. Jones); Ft. Collins, June 28, 1900; Red Rocks Park, Morrison, June 14, 1933 (Helene Gibbons); White Rocks, near Boulder, June 2 and 4, 1933 (M. & H. James); Roggen, July 6 and 7, 1937 (James & Moss).

98. **Promachus rufipes** (Fabricius), 1775, Syst. Ent., p. 794. Sedgwick Co., July 19, 1933.

99. **Promachus vertebratus** (Say), 1823, Jour. Acad. Sci. Philad., 3: 47. Crystal Springs Country Club, Flagler, July 25, 1933 (Rodeck & James).

100. **Promachus oklahomensis** Pritchard, 1935, Amer Mus. Nov. 813, p. 12. South of Cheyenne Wells, July 27, 1933 (Rodeck & James); Sterling, July 10, 1934 (C. R. Jones).

101. **Promachus fitchii** Osten Sacken, 1878, Catalogue, p. 234, Note 121. Boulder, June 26 and July 20, 1933 (James); 2 miles south of Boulder, July 9, 1933 (C. A. Wagner); Las Animas, June 2, 1931 (Leonard Sweetman).

PROCTACANTHELLA Bromley

Key to the described species.

1. Abdomen with a contrasting row of mid-dorsal spots; male genitalia with a posteriorly directed fan of long bristles on either side of the ninth sternite ------ **jamesi**
   Abdomen with at most slightly darker dorsal spots, male genitalia without a ventral fan ------------------------- 2
2. Upper male forceps protruding half their length beyond the lower ones; male genitalia without a terminal pencil of hairs ----------------------------------**leucopogon**
   Upper forceps subequal in length to the lower ones, male genitalia tipped with a pencil of fine white hairs --- --------------------------------------- **cacopiloga**

102. **Proctacanthella jamesi** Prichard, 1935, Amer. Mus. Nov., 813, p. 13. Paratypes from Trinidad.

103. **Proctacanthella leucopogon** Williston, 1893, Kans. Univ. Quart., 2: 75. Common: Ft. Collins; White Rocks, near Valmont; Genoa; Cheyenne Wells; Ordway; Kit Carson; Pagosa Junction; Arboles; Francis. Late June to Aug.

104. **Proctacanthella cacopiloca** Hine, 1909, Ann. Ent. Soc. Amer., 2: 165. The most common Asilid of the Eastern Colorado plains: La Porte; Ft. Collins; Fossil Ridge, south of Ft. Collins; Boulder; White Rocks, near Valmont; Roggen; Prowers; Chivington; Burlington; Two Buttes Reservoir; Eads; Hoehne; Model; Holly; Mesa de Mayo, near Tobe; Cimarron River, south of Lamport; Cheyenne Wells; Crowley; Ordway; Boone; Las Animas; Lamar; Kiowa Co.; Huerfano Co.; Sand Dunes, Alamosa. June to Sept.

ERAX Scopoli

Hine, 1919, Ann. Ent. Soc. Amer., 12: 103-157.*

105. **Erax candidus** (Coquillett), 1893, Canad. Ent., 25: 176. This is our only representative of the **anomalus** group, members of which have three submarginal cells; however, three submarginal cells occur as an abnormality in occasional specimens of other species, such as **barbatus**, **bicaudatus**, and **pallidulus**. Holly, July 31, 1933 (Rodeck & James).

106. **Erax rufibarbis** Macquart, 1838, Dipt. Exot., I, 2, p. 116. Common: Pagosa Springs; Pogosa Junction; Ignacio; Almont, Gunnison Co.; Ft. Garland; Manitou; Saguache; Ordway; Masonville. Aug., Sept.

107. **Erax bicaudatus** Hine, 1919, Ann. Ent. Soc. Amer., 12: 138. Holotype from Montclair; allotype from Morrison. Our most common fall **Erax**: Ft. Collins; Masonville; Hygiene; Bennet Creek; Home; Boulder; White Rocks; Four Mile Canyon, Boulder Co.; Valmont; Hudson; Denver; La Porte; Lindenmeyer Site, 30 miles north of Ft. Collins; Manitou; Ft. Garland; Atwood; Boone; Crowley; Olney Springs; Pueblo; Kim; Pritchett. Late July to Oct. The May record on the allotype specimen may be in error.

108. **Erax interruptus** (Marquart), 1834, Hist. Nat. Dipt., 1, p. 310. Cimarron River, south of Lamport, Aug. 2, 1932 (Rodeck & James); Holly, July 31, 1933 (Rodeck & James); Ordway, Aug. 16, 1934, and July 19, 1936 (Fred Kropf).

109. **Eras varipes** Williston, 1885, Trans. Amer. Ent. Soc., 12: 71. Recorded by Tucker from Denver. Las Animas, June 21, 1931 (Leonard Sweetman); Burlington, July 27, 1933 (Rodeck & James); Crystal Springs Country Club, Flagler, July 25, 1933 (Rodeck & James); Manitou, Aug. 6, 1905; Boulder, July 17, 1934 (Ed. C. Smith).

110. **Erax dubius** Williston, 1885, Trans. Amer. Ent. Soc., 12: 64. Boulder, July 6, 1932 (James).

111. **Erax stamineus** Williston, 1885, Trans. Amer. Ent. Soc., 12: 68. (not **stramineus**). Recorded by Tucker from Buffalo. Common in grassland near the foothills: Boulder; Owen's Lake, near Valmont; White Rocks, near Valmont; Ft. Collins; Horsetooth Mountain, Larimer Co.; College Pasture, Ft. Collins; Inspiration Point, Denver; Home; Virginia Dale; Evergreen; La Porte. June to Aug. at lower, Aug to Sept. at higher elevations. **E. rapax** replaces this species at lower elevations in July and Aug.

112. **Erax rapax** Osten Sacken, 1887. Biol. Centr. Amer. Dipt., I, p. 201. Common in grassland, near foothills and mountains: Boulder; Left Hand Canon, near Jamestown; White Rocks, near Valmont; Owen's Lake, near Valmont; Horsetooth Mountain, Larimer Co.; Virginia Dale; Masonville; Home; Ft. Collins; Inspiration Point,

*__Erax tanneri__ Bromley is not included in Hine's key.

Denver; La Porte; Custer Co.; Saguache; Lonetree; Hesperus; Rockwood, La Plata Co. Late June to Sept.

113. **Erax argyrosoma** Hine, 1911, Ohio Nat., 11: 310. Las Animas, July 11 to Aug 13 (Leonard Sweetman); Canon City, June 1 and 4, 1939 (Jack Jones); Delta, July 1, 1938 (Bauer).

114. **Erax pallidulus** Hine, 1911, Ohio Nat., 11: 309. Las Animas, Aug. 13, 1933 (Leonard Sweetman); La Veta, July 22, 1929 (Rodeck); Saguache, July 20, 1929 (Rodeck); on Two Buttes, Aug. 1, 1933 (Rodeck & James); Two Buttes Reservoir, Aug 1, 1933 (Rodeck & James).

115. **Erax tanneri** Bromley, 1937, Proc. Utah Acad. Sci., Arts, and Letters, 14: 105. Holotype from Buena Vista.

116. **Erax affinis** Bellardi, 1861, Saggio, II, p. 41. Recorded by James from Gateway and Lake Creek.

117. **Erax aestuans** (Linnaeus), 1767, Syst. Nat., 12th. Ed., p. 1007, 5. Recorded by Cockerell from North Four Mile Canyon, near Boulder. One Colorado specimen, without locality.

118. **Erax kansensis** Hine, 1919, Ann. Ent. Soc. Amer., 12: 122. I have no Colorado records, but the following locality is less than a mile from the Colorado line: Coolidge, Kans., July 31, 1933 (Rodeck & James).

119. **Erax jubatus** Williston, 1885. Trans. Amer. Ent. Soc., 12: 66. Recorded from Pike's Peak by Cockerell. Widespread in the mountains: Ft. Collins; Masonville; Home; Boulder; Gregory Canyon, near Boulder; A.S.U.C. Lodge, near Boulder; Nederland; Grand Junction; Trujillo; Lone Tree. Sept. and Oct.

120. **Erax subcupreus** Schaeffer, 1916, Jour. N. Y. Ent. Soc., 24: 66. Pagosa Junction, July 4, 1934 (Rotger); Arboles, June 28, 1935 (Rotger); Hesperus, July 3, 1935 (Rotger).

121. **Erax costalis** Williston, 1885, Trans. Amer. Ent. Soc., 12: 64. Recorded from Colorado, without locality, by Hine.

122. **Erax subpilosus** Schaeffer, 1916, Jour. N. Y. Ent. Soc., 24: 67. Francis, June 27, 1934 (Rotger).

123. **Erax snowi** Hine, 1919, Ann. Ent. Soc. Amer., 12: 116. Part of the type series is from Colorado, without locality. Francis; Arboles; Horsetooth Gulch, Larimer Co.; College Pasture and Spring Canyon, near Ft. Collins; Chimney Rock. Late May to Aug. This is our earliest **Erax** in chaparrel near Ft. Collins.

124. **Erax barbatus** (Fabricius), 1805, Syst. Antl., p. 169. Our most common early summer **Erax.** Arboles; Palisade; Delta; Walker Hill, near Crowley; Rocky Ford; Ordway; Crowley; Chivington; Lamport; Roggen; White Rocks, near Valmont; Ft. Collins; Sterling. June to Aug.

125. **Erax willistoni** Hine, 1919, Ann Ent. Soc. Amer., 12: 110. Part of the type series was collected by Tucker, probably near Co-

lorado Springs, though Hine gives no definite locality.

MALLOPHORINA Curran

Because of the unsatisfactory status of species of this genus at the present writing, I am not citing or presenting any keys. Determinations of the species of this genus were made for me by Dr. S. W. Bromley.

126. **Mallophorina guildiana** (Williston), 1885, Trans. Amer., Ent. Soc., 12: 60. Cortez, July 20, 1933 (Kenneth Maehler); Newcastle, Aug. 2.

127. **Mallophorina acra** (Curran), 1931, Amer Mus. Nov., 487, p. 21. South of Lamport, Aug. 2, 1933 (Rodeck & James).

128. **Mallophorina frustra** Pritchard, 1935, Amer. Mus. Nov., 813, p. 11. La Veta, Aug. 5, 1938 (James & Lanham); La Veta Pass, Aug. 5, 1938(James & Lanham); Arboles, Aug. 1, 1934 (Rotger).

129. **Mallophorina prudens** Pritchard, 1935, Amer. Mus. Nov., 813, p. 10. Cortez, July 20, 1933 (Kenneth Maehler).

130. **Mallophorina fulviventris** Macquart, 1850, Dipt. Exot., Suppl. IV, 381. This species has gone by the names of **M. clausicella**; the latter is an eastern species, and most probably does not occur in Colorado. La Veta, Aug. 5, 1938 (James & Lanham); Boulder Canyon, Aug. 2, 1930 (Beulah Blair); Boulder, July 27 and Aug. 3, 1934 (James).

MALLOPHORA Macquart

Curran, 1930, Amer. Mus. Nov., 415, p. 12-14 (includes **Mallophorina**).

131. **Mallophora fautricoides** Curran, 1930, Amer. Mus. Nov., 415, p. 13. "Colorado Mountains," July 25 (C. P. Gillette).

PROCTACANTHUS Macquart

Key to species found in Colorado

1. Abdomen red, except the first segment and the anterior border of the second ---------------------------------**hinei**
   Abdomen black, gray- or yellow- pollinose ----------------- 2
2. Male genitalia elongated, the appendages curved inward at the tips and enclosing an open space beyond the other parts (Utah and westward) ------------------- **arno**
   Male genitalia relatively short, and not enclosing an open space --- 3
3. Abdomen with stubby black hairs on most segments, at least on the second, third, and fourth ------------**micans**
   Abdomen often with black bristles, but without any considerable amount of stubby black hair on the segments -- 4
4. Third antennal segment, excluding arista, three times as long as wide; bristles of thorax, scutellum, and abdomen mostly or wholly white --------------------**rodecki**

Third antennal segment less than twice as long as wide; bristles of thorax, scutellum, and abdomen usually mostly black .... **milbertii**

132. **Proctacanthus hinei** Bromley, 1928, Psyche, 35: 13. Cimarron River, south of Lamport, Aug. 2, 1933 (Rodeck & James).

133. **Proctacanthus micans** Schiner, 1867, Verh. Zool.-Bot. Ges. Wien, p. 397. Widespread in southern Colorado: Canon City; Beulah; Saguache; Arboles; Hesperus; Ignacio; Francis; La Plata Co.; Grand Junction. July to Aug.

134. **Proctacanthus rodecki** James, 1933, Amer. Mus. Nov., 596, p. 2. Type series from Roggen. Cimarron River, south of Lamport, Aug. 2, 1933 (Rodeck & James).

135. **Proctancanthus milbertii** Macquart, 1838, Dipt. Exot., I, 2, p. 124. Recorded by Tucker from Colorado Springs. Widespread: La Porte; Roggen; Wales Canyon, Pueblo Co., Kiowa Co.; Burlington; Eads; Chivington; Cope; Ordway; Francis; Alamosa Sand Dunes. Late June to Sept.

POGONOSOMA Rondani

Cresson, 1920, Ent. News, 31: 211-215.

136. **Pogonosoma ridingsi** Cresson, 1920, Ent. News, 31: 214. Types from Florissant and El Paso Co. Boulder, July 1, 1906.

BOMBOMIMA Enderlein

Key to species found in Colorado

1. First abdominal segment with some dense yellow pile laterally; the second and third segments almost entirely yellow-haired .... **fernaldi**

   First abdominal segment clothed entirely with black pile; that of second to fifth segments almost entirely red dorsally .... **engelhardti**

137. **Bombomima fernaldi** (Back), 1904, Canad. Ent., 36: 290. Similar in appearance to, and may be confused with, **Laphria janus**. Recorded by Cockerell from Teller Lake. Type from Colorado, without stated locality. Widespread: Pingree Park; Cherokee Park; A. S. U. C. Lodge, near Boulder; Long's Peak; Estes Park; Lump Gulch, near Gilpin; Huerfano Co. July, Aug.

138. **Bombomima engelhardti** Bromley, 1931, Ann. Ent. Soc. Amer., 24: 434. More southern than **fernaldi**, with which it intergrades in central-western Colorado. Type from "Southwestern Colorado," without stated locality. C. J. D. Brown's record of **D. fernaldi** from Mesa Verde Nat. Park, may apply to this species. Hesperus, Aug. 6, 1935 (Rotger) Lonetree, June 9, 1934, and July 10, 1935 (Rotger).

ATOMOSIA Macquart

Curran, 1930, Amer. Mus. Nov., 425, p. 15-20.

139. **Atomosia melanopogon** Hermann, 1912, Abh. Kaiserl. Leop.—Carol. Deut. Ak. der Naturf., 96: 144. Burlington, July 26, 1933 (Rodeck & James).

ANDRENOSOMA Rondani

McAtee, 1919, Ohio Jour. Sci., 19: 244-248 (Nusa). Curran. (Amer. Mus. Nov., 487, p. 19-20, 1931) makes no mention of any species listed in McAtee's paper, except A. **fulvicauda,** as A. (?**pyrrhacra** Say).

140. **Andrenosoma fulvicauda** ssp. **lutea** (Cresson), 1919. Ohio Jour. Sci., 19: 245. Type of subspecies, from "Col. (orado)."

LAMPRIA Macquart

Bromley, 1934, Ann Ent. Soc. Amer., 27: 84.

141. **Lampria rubriventris** Macquart, 1834, Hist. Nat. Dipt., I, p. 284. A female, Boulder, July 27, 1934 (James) may represent an unnamed subspecies; the abdomen becomes black beyond the fourth segment, and the mystax has a considerable number of black bristles. It is larger (16 mm.) than specimens in my collection from Brownwood, Tex., and the abdomen, on the paler parts, is more of a brownish red; the size, however, is well within the range given by Bromley(9-21 mm.).

LAPHRIA Meigen

McAtee, 1918, Ohio Nat., 19: 143-170.

142. **Laphria vultur** Osten Sacken, 1877, West. Dipt. p. 286. Recorded by McAtee from North Cheyenne Canyon, El Paso Co.

143. **Laphria janus** McAtee, 1918, Ohio Nat., 19: 153. Paratypes from Creede and Tolland. Pingree Park. Aug. 14-19, 1933 (M. & H. James), Aug. 17, 1932 (James), and Aug. 16, 1933 (Helene Gibbons); Steamboat Springs, July 23, 1933 (Gibbons).

144. **Laphria gilva** (Linnaeus), 1758, Systema Naturae, 10th Ed., 227, 6. Recorded by McAtee from Empire and Estes Park. Pingree Park, Aug. 19-22, 1935 (M. & H. James).

145. **Laphria vivax** Williston, 1883, Trans. Amer. Ent. Soc., 11: 30. Recorded by McAtee from Summit Co., and Marshall Pass; University Camp (Science Lodge), Boulder Co., July 20, 1939 (W. H. Peters). A female, Science Lodge, July 13, 1939 (Lanham) may represent a distinct variety of the above; it has reddish-yellow pile on the body and the legs are wholly black pilose.

146. **Laphria aimatis** McAtee, 1918, Ohio Nat., 19: 160. Recorded by McAtee from El Paso Co., and from Colorado without cited locality. Boulder, July 21, 1928 (C. A. Wagner).

147. **Laphria felis** (Osten Sacken), 1877, West. Dipt., p. 286. An extremely variable species. The following named varieties occur in Colorado:

Var. **felis** Osten Sacken. Science Lodge, June 27-July 20,

1939 (Lanham) and July 9, 1932 (James); Home, Sept. 9, 1938; Masonville, Sept. 6, 1934.

Var. **varipes** McAtee, 1918, Ohio Jour. Sci., 19: 163. Part of type series from Colorado, without cited locality. Science Lodge, July 4, 1939 (Lanham).

Var. **atripes** McAtee, 1918, Ohio Jour. Sci., 19: 163. Type from Tolland. Pingree Park, Aug. 14-19, 1933 (M. & H. James).

Var. **xanthippe** Williston, 1883, Trans. Amer. Ent. Soc., 11: 31. Science Lodge, Aug. 2, 1939 (Lanham).

LITERATURE CITED

Back, E A 1909 Robberflies of America, north of Mexico, belonging to the subfamilies Leptogastrinae and Dasypogoninae Trans Amer. Ent. Soc., 35: 137-400

Bromley, S W. 1934 The robber flies of Texas Ann Ent Soc Amer, 27 74-113.

Brown, C J D 1920 A morphological and systematic study of Utah Asilidae. Trans Amer. Ent Soc, 54 295-320

Cockerell, T D A 1917. The fauna of Boulder County, Colorado, III. Univ of Colorado Studies, 12 5-20

Hine, J S. 1909 Robberflies of the genus Asilus Ann Ent Soc. Amer, 2: 136-172

— — 1911 Robberflies of the genera Promachus and Protacanthus Ann Ent. Soc Amer, 4 153-172

— 1919 Robberflies of the genus Erax Ann Ent Soc Amer, 12: 103-157.

Tucker, E. S 1907 Some results of desultory collecting of insects in Kansas and Colorado Kansas Univ Sci Bul 4: 51 108

— — 1908. Additional results of collecting insects in Kansas and Colorado Trans Kan Acad Sci, 21: 276-304

NEW DISTRIBUTIONAL NOTE ON NOTONECTA BOREALIS, B & H

In the undetermined collection of water bugs from University of Colorado Museum there is a male specimen of **Notonecta borealis** B & H bearing the label "Boulder Co., Colorado, Aug. 1939. Hugo G. Robeck." Previous records are from Quebec and British Columbia in Canada and Michigan and Minnesota in the United States.

H. B. HUNGERFORD

HOST RELATIONS AND GEOGRAPHIC DISTRIBUTION OF NEW SPECIES OF THE GENUS EURYTOMA FROM MEXICO*

ROBERT E. BUGBEE, Fort Hays Kansas State College

In the fall of 1931 and 1935 Dr. A. C. Kinsey of Indiana University made two trips into Mexico to collect gall-making wasps of the family **Cynipidae.** Among several families of the Chalcidoidea which emerged from the galls were representatives of two genera (**Decatoma** and **Eurytoma**) of the family **Eurytomidae.** This material was turned over to me and a study of the parasites representing the genus **Eurytoma** has been underway for a period of about 3 years. The study has progressed far enough to allow certain interesting observations to be made concerning host and parasite relations and distribution. In all cases the hosts of the parasites have been determined and checked by Dr. Kinsey.

It has been shown by Kinsey (1923 and 1930)[1] that the majority of cynipids are limited to single species of host plants, chiefly oaks, or to two or more species of closely related host plants. One of the purposes of this study was to try and determine the relationship of the parasites to the cynipid hosts. Would the parasites show any evidence of having developed a host restriction as close as that of the gall-makers to their host plants?

The Mexican material consisted of about 1500 specimens from some 27 localities. Probably an equal amount of material could not be included in this study because of poor condition or too short series. Without knowing anything about their host relationship or distribution the parasites were divided into three main groups on the basis of differences in structure. As the systematics of the material have not been finally defined yet, they will be referred to as Groups I, II, and III. Each group in turn was divided into species. Only after the division into the three groups and those in turn into species had been accomplished were the hosts and distributional data investigated. A close correlation was found to exist between the hosts and parasites.

Group No. I consists of five, easily distinguished, parasitic species bred from five distinct host species belonging to the cynipid genus **Amphibolips,** which in turn are confined to four species of black oaks. Two of the parasitic species occur at the same locality and were bred from galls taken from the same species of oak (**Quercus serrulata**) but the host gallmakers are quite different and the two parasitic species are easily separated. It would seem that the two species must represent host segregates.

---

*Read before the Entomological Society of America at the meeting of A. A. A. S. in Philadelphia on Friday, Dec. 27, 1940.

Four of the species are grouped together and one species is segregated by itself. This one lone species appeared different enough from the other four in the preliminary study so that it was thought of as representing a separate complex of group I. Later its host was also found to be in a separate complex (niger complex) of the genus **Amphibolips.** Thus this group of five species forms a close-knit series of parasites, each species of which occurs on a single host species, at present confined to the Wes'ern Sierra of Mexico on black oaks found at an elevation of 7700-8500 feet.

Group No. II of this Mexican material also forms a closely related unit of 6 species. All have been bred from hosts belonging to the cynipid genus **Disholcaspis**, which occur on five species of white oaks. Five of the **Disholcaspis** hosts are distinct species while the 6th has not yet been determined. The hosts are divided into two complexes (i. e. the **fungiformis** and **perniciosa** complexes) but sufficient grounds for such a division of the parasites has not yet been discovered. This group, as now known, occurs at an elevation of from 5400 to 7600 feet along the Western Sierra from the northern part of the state of Chihuahua south of the state of Querétaro and Jalisco. **Disholcaspis** species have also been described from the Eastern Sierra of Mexico so that the extension of this group of parasites to include both mountain ranges may be expected in the future.

Group number III is the largest one and consists of 16 species which are divided into 4 sub-groups or complexes. The first complex consists of seven parasitic species bred from seven distinct species of the genus **Disholcaspis** on five species of white oaks. The hosts are divided into several complexes but no such division of the parasites seems warranted. Bred from one locality, from the same host on the same species of white oak are two quite different parasitic species although they belong together in this same sub-group. It is possible that hyperparasitism may be involved. The two species are quite different structurally especially in the female genitalia and abdominal characteristics. This subgroup ranges from northern Chihuahua southward along the Western Sierra of Mexico to the states of Querétaro and Jalisco at an elevation ranging from 5600 to 9500 feet. Other unknown species may be expected to occur on the Eastern Sierra as well.

Group No. II and this first subgroup under number III are bred from hosts of the same gall-making genus, namely **Disholcaspis.** In several cases two distinct species of parasites have been bred from the same **Disholcaspis** gall-making species but one will belong to group II and the other to this first subgroup of group III.

Subgroup II of group III consists of two species bred from 2 species of the gall-making genus **Andricus** on two species of white oaks. The two occur at remote localities and are confined to the Western Sierra of Mexico at an elevation of 8000 to 8500 feet.

Subgroup III consists of two species parasitic on two species of the genus **Andricus** on one species of white oak. They are found at present on the Eastern Sierra of Mexico in neighboring states at elevations of 3200 and 6000 feet, respectively.

The last subgroup contains five species which emerged from five species of the gall-making genus **Biorhiza,** which are placed in two complexes (**pulchripennis** and **eburnea**). The parasites fail to show a similar division. They are very small insects occuring at an elevation of 6000 to 9200 feet on three species of white oaks. They are known at present only from the Eastern Sierra of Mexico. At one locality two of the species occur together but one is found on a distinct species of gall-maker on a tall oak **Q. rhodophlebia** while the other species occurs on a second host species on a dwarf oak **Q. repanda.** Two of the parasitic species emerge in December and January rather than in June and July, as do the other three.

Up to the present time only four species have been previously described from Mexico. They are **Eurytoma tepicensis** Ashmead (1895)[2], **E. auriceps seminatrix** Walsh (1870)[3], **Bruchophagus herrerae** Ashmead (1902)[4] which, according to Gahan, (1932),[5] is the same as **E. tylodermatis** Ashmead (1896)[6] and **Eurytoma compressa** Bugbee (1939).[7] Of these **E. tepicensis** had no host designation. **E. auriceps seminatrix** was reported by Walsh as bred from the Cynipidous oak-gall **seminatrix** Harris=**Andricus (Callirhytis) seminator** on **Q. alba.**

For several reasons not enumerated here the occurance of **E. auriceps seminatrix** in Mexico seems very unlikely and so it is not considered further. **Bruchophagus herrerae** according to Ashmead parasitized the cotton-weevil **Anthonomus grandis,** and placing it as a synonym of **E. tylodermatis** its hosts become multiplied to include Lepidopterous, Colecpterous and Hymenopterous records **E. compressa** is a phytophagus species found in the seeds of a Sumac, **Rhus virens.**

An attempt has been made to determine where the species mentioned above fit into the picture as already outlined. The type of **E. tepicensis** was located and some material was sent to be compared with the single female type. The description which came back with the material indicates that **E. tepicensis** belongs in group III under the first subgroup. **E. tylodermatis** and **E. compressa** seem to be nearest group II but each one represents a distinct subgroup or complex, apart from the species concerned in this review.

In summary it may be stated that:

1. The parasites and host of the Mexican material display a close relationship. Each parasitic group is confined to a distinct host genus and as far as known to distinct host species (with two exceptions) within the genus.

2. In the cases where 2 parasitic species are found on the same gall-making host at the same locality on the same oaks the parasites are quite different structurally.

3. In the cases where two parasitic species are found in the same locality but occur on separate gall-making hosts of the same genus the evidence seems to indicate strongly that they represent host segregates.

In other cases in the genus **Eurytoma**, however, host restriction is not so clearly defined as in the Mexican material. For instance, **E. rhois** Crosby, is reported from three closely related but distinct sumac hosts (**Rhus glabra, R. typhina and R. copallina**) Bugbee, (1937)[7] **E. appendigaster** Swederus has been reported from Lepidopterous and Hymenopterous hosts and **E. tylodermatis** Ashmead from Coleopterous, Hymenterous, and Lepidopterous hosts. Instances of extreme host restriction as well as considerable latitude in choice of hosts thus do occur side by side within the same genus.

One interesting additional point may be mentioned. Several species have given records of more than one year emergence. In one such case the galls were collected in the fall of 1931. In the spring of 1932, 33, 34 and 35, there occurred an emergence of both males and females. Bridwell (1923)[8] and Bugbee (1939)[7] had observed this phenomona before in this genus (i. e. in **E. rhois** Crosby). Bridwell believed that such factors as drouth and temperature would account for the delayed emergence and that it was an adaptation which helped the insects over unfavorable periods.

LITERATURE CITED

1. Kinsey, A. C. Indiana University Studies, 10(58): 13-16, 1923 16(84, 85, 86): 51 1930
2. Ashmead, W. H. Proc California Acad Sci, 5 539 555, 1895
3. Walsh, B. D Amer. Ent. and Bot. 2(10). 209, 1870
4. Ashmead, W. H. Psyche, 9:324, 1902
5. Gahan, A B. Anns. Ent. Soc. Amer., 25. 738, 1932.
6. Ashmead, W. H. Amer. Ent. Soc Trans, 23. 179-234, 1896.
7. Bugbee, R E. Anns. Ent. Soc. Amer., 32 415-427, 1939
8. Bridwell, J. C. Jour. Washington Acad. Sci., 13. 262, 1923.

A NEW NEARCTIC SPECIES OF EXOPALPUS (TACHINIDAE, DIPTERA)[1]

H. J. REINHARD, College Station, Texas

The new species herein described has been represented in my collection for some years by a single male specimen from Chisago County, Minnesota. It was determined in 1929, by the late Dr. J. M. Aldrich, as **Arthrochaeta intermedia** vdW., and subsequently this determination was changed to **Exopalpus**, new species. In 1938 some 30 odd specimens, mostly females, were discovered in a collection of Michigan Tachinidae received from R. R. Dreisbach. This series shows some variations in chaetotaxy; most specimens possess three posterior dorsocentral bristles and trace to **Arthrochaeta**, but several have four posterior dorsocentrals and accordingly trace to **Exopalpus** in Townsend's key to Dejeaniini (Manual of Myiology, Part III, 1936, p. 177). The type species of **Arthrochaeta** Brauer and Bergenstamm is **A. demoticoides**, from Venezuela (Musc. Schiz., 1, 1889, p. 101); and **Exopalpus** Macquart was described from Colombia, with **E. bicolor** as the type species (Dipt. Ex. Sup., IV, 1851, p. 149). I have not seen either of the genotypes, but both have been redescribed recently by Dr. C. H. T. Townsend (Manual of Myiology, Part VIII, 1939, pp. 71-2 and 83-4). A study of these descriptions discloses no outstanding differences; in fact, the essential characters listed for each are quite similar. The minor differences pointed out certainly do not justify generic distinction here, and **Arthrochaeta** may be sunk as a synonym of **Exopalpus**. Distribution of the genus appears restricted largely to high altitudes in the tropics, and the present species is apparently the first Nearctic form that has come to light. The holotype is deposited in the Kansas University Collection.

Exopalpus pompalis, n. sp.

A somewhat narrowed, medium-sized, bicolored species in which the thick yellow pollen on the thorax contrasts sharply with the shiny blue-black abdomen.

Male.—Front at vertex slightly exceeding width of eye, widening gradually downward to antennal base; parafrontals yellow to golden pollinose, clothed with fine erect black hairs; median vitta reddish brown, tapering toward triangle and much narrower than one parafrontal; verticals two pairs, equally stout, inner ones decussate; ocellars absent; frontal bristles strong, subreclinate, two pairs below base of antennae and one or two bristles outside of main row on anterior part of front; clypeus transversely convex at middle, silvery or white pollinose; epistoma moderately produced; vibrissae stout, decussate, set slightly above oral margin; facial ridges flattened

[1]Contribution No. 644 from the Division of Entomology, Texas Agricultural Experiment Station.

with two or three bristly hairs on lower extremity; parafacial silvery white, wholly pale-haired, and hardly equal one-fourth clypeal width; antennae nearly as long as face, reddish yellow, third segment usually infuscated, about twice longer than broad with front edge convex and apex obliquely truncate; second segment one-half length of third, tapering from apex to base; arista brownish, finely pubescent, two basal segments elongate, apical one tapering gradually outward from base; cheek silvery, moderately pale-haired, about two-fifths eye height; eyes distinctly but not thickly pilose; proboscis rather slender, shorter than head height; palpi yellow, slightly thickened at tip, beset with short black hairs; back of head including posterior orbits golden pollinose above, becoming paler or whitish on lower part, thickly clothed with hairs.

Thorax and scutellum with heavy yellow to golden lusterless pollen above, which is interrupted on the former by four narrow black vittae; pleura dusted with thiner paler pollen, wholly black-haired. Chaetotaxy: acrostichal 3,3: dorsocentral 3,3 (sometimes 3,4); presutural 2; posthumeral 2; humeral 5 or 6; notopleural 2; supraalar 3; intraalar 3; postalar 3; sternopleural 2,1; pteropleural 2 (1 larger than sternopleurals); scutellum usually with 3 lateral (sometimes 4) and a smaller decussate apical pair, disc bearing numerous erect bristles with three in a transverse preapical row somewhat stouter than the rest; infrascutellum normally developed, yellowish pollinose; propleura pale-haired; prosternum bare; calypters opaque, whitish with a tawny tinge.

Abdomen barely wider than thorax, ovate, moderately arched and wholly shining above without a trace of pollen except on sides of fourth segment, latter reddish on extreme tip; venter also with a reddish tinge in the ground color which extends upward to include sides of segments two and three; sternites exposed and moderately bristled; intermediate segments each with a pair of stout discals; first without median marginals and second with a strong pair; third bearing a marginal row of 8 or 10 bristles and the fourth segment with a marginal and a discal row of somewhat smaller bristles; genital segments small, reddish black; forceps united, short, tapering to a blunt shiny tip; accessory plate terminating in a bowed finger-like process, which nearly equals the forceps in length; fifth sternite shining blackish, rather broadly and deeply incised, lobes sparsely clothed with black hairs.

Legs blackish and rather strongly bristled; mid tibia bearing a row of irregular bristles on outer front side; hind tibia not ciliate; tarsi normally developed; claws and pulvilli elongate.

Wings extending well beyond tip of abdomen, with a distinct brownish tinge becoming darker on stigma, extreme base paler or

yellowish; first vein bare, third setulose half way or more to small cross vein; fourth vein with an almost rectangular bend, thence extending diagonally toward costa leaving first posterior cell narrowly open well before extreme wing tip; hind cross vein oblique, joining fourth about one-third the distance from bend to small cross vein; epaulets reddish; costal spine small.

Female.—Front at vertex slightly wider than in male; frontals in a single row; two strong proclinate orbital bristles; third antennal segment narrower and but slightly longer than second; abdomen wider, sides and venter wholly black; genitalia retracted, not adapted for piercing; intermediate segments of fore tarsi noticeably flattened; claws and pulvilli short; otherwise as in male.

Length, 8.5 to 11 mm.

Types.—Holotype, female, Midland, Michigan, August 20, 1939 (Eugene Kenaga); allotype, male, Chisago County, Minnesota, July 15, 1911, no collector's label. Paratype: 1 female, same data as holotype; 43 females and 1 male, Midland County, Michigan, August and September 1937-39 (R. R. Dreisbach and Geo. Steyskal); 1 male, Baraga County, Michigan, August 5, 1937 (R. R. Dreisbach).

A BAT FLEA NEW TO ARKANSAS

On January 19, 1941, a female of the big brown bat, **Eptesicus fuscus** Beauv., was collected in Indian Cave, Benton Co. Arkansas, by Eugene Crawley. We secured a single male flea from the bat and determined it as **Eptescopsylla chapini** (Jordan). This determination was confirmed by Dr. Newell E. Good, U. S. Public Health Service, San Francisco, Calif., and the flea is deposited in his collection. Heretofore this flea was recorded only from Maryland and Kentucky (Fox, Irving. 1940. Fleas of eastern United States, pp. 107-108).

MILTON W. SANDERSON

THE ORDER EMBIOPTERA NEW TO ARKANSAS

One adult female of **Anisembia texana** (Mel.) was collected at Parkdale, Arkansas, June 14, 1939 by beating Spanish moss. The specimen was determined by Doctor Edward S. Ross of the California Academy of Sciences. This species has heretofore been recorded only from Texas and Mississippi.* At College Station, Texas in March, 1930, specimens of this species were collected from Spanish moss.

MILTON W. SANDERSON

*Ross, E. S. 1940. A revision of the Embioptera of North America. Ann. Ent. Soc. Amer., 33: 651-652.

SOME NEW SPECIES OF SYRPHIDAE

FRANK M. HULL, University of Mississippi

In this paper I present the description of three new Syrphid flies from South America. Types are in the author's collection.

Baccha susio n. sp.

Related to the **clarapex** wied but distinguished by the ochraceous-brown coloration, and the slender paired spots upon the abdomen.

Female. Length 10 mm. **Head:** Cheeks light brown, face yellowish-brown along the sides, blackish along the tubercle in the middle. Vertex blackish above, with a single median row of short, black hairs. Front brownish-black broadly throughout the middle; pale brown along the edges. Antennae brown, the third joint darker apically and dorsally and about half again as long as wide. **Thorax:** mesonotum dark brown, feebly shining including the lateral margin, the middle of the disc with a pair of conspicuous, light, yellowish-brown pollinose vittae widely separated between which is a much more slender one running from anterior margin all the way to the scutellum. These vittae have brassy reflections. The post calli and the humeri are brown, the latter paler. Pleurae brownish black, the pro-, meso-, ptero- and upper sternopleurae obscurely reddish brown, densely covered with silvery pubescence and with some scattered pale pile. The mesonotum itself is broadly covered with pale, whitish-brown pubescence and with very short, sparse black pile. Scutellum light, brownish-yellow, obscurely brown across the disc with short, sparse, stubby, black pile and blackish ventral fringe. **Abdomen:** considerably constricted basally, dark brown in color, including the first segment and marked very vaguely with diffuse spots as follows: a pair of submedial, rather small, light brown elongate spots well separated in the middle of the third segment; fourth segment with a pair of similarly placed and colored spots and the lateral anterior corners diffusely lighter brown. Fifth segment over twice as wide as long and a little shorter than the preceeding segment but with a similar arrangement of spots. Sixth segment rather long, flattened, ridged in the middle and though only half again as long as wide, the basal width is much narrower than that of the preceeding segment. This segment is apically pointed and laterally strongly compressed. Pile of the abdomen black except for a few long pale hairs at the extreme base of the first segment. **Legs:** front and middle tibiae and tarsi pale yellow, the last two tarsal joints barely darker and a mere suggestion of brownish, submedial annulus on the tibiae. Anterior femora brown, middle pair darker, the hind pair quite dark brown, their pile brownish black. Hind tibiae, except extreme base, dark brown. Hind tarsi quite pale yellow, the extreme base of basi

tarsi brownish. **Wings:** diffusely tinged with brown along the anterior half.

Holotype: One male, S. Avanhandara, 28-4-08, E. S. Paulo. Received some years ago in miscellaneous material from Brazil.

Mesogramma steatogaster n. sp.

Related to **planiventris** Lw.; the abdomen much wider, front rugose.

Female. Length 5.5 mm. **Head:** cheeks black, face only moderately produced, pale yellow, the sides whitish pubescent; the yellow is extended linearly up the sides of the front to within a short distance of the ocelli. The occipital pile is pale yellow, the vertical pile black, frontal pile brown becoming black on either side of the antennae. The front is broadly steel-blue, shining, for the most part flattened, markedly transverse rugulose with a median brown line. **Thorax:** mesonotum with the ground color strongly obscured by light olive-brown pollen, the pile pale. Down the midline is a broad posteriorly evanescent, feebly shining, steel-blue vittae; the propleurae, posterior half of mesopleurae, pteropleurae and upper part of sternopleurae yellow as are the humeri, the broad sides of the mesonotum and the whole of the scutellum. Scutellar pile sparse, rather long, black, erect, considerably longer on the margin, and without ventral fringe. **Abdomen:** very broad, and flattened, light brownish-yellow in color marked with black as follows: a narrow, parallel-sided, submarginal, posterior fascia reaching the lateral margin at its full width on the third segment; fourth segment similarly marked, fifth with a conspicuous, median, oval black spot from base almost to apex and in each posterior corner a tiny black spot and a submarginal posterior black line. Pile of abdomen everywhere black except on the broad, pale first segment and the basal half of the second segment. **Legs:** wholly pale yellow except for a blackish, subapical annulus on the hind femora and the last three joints of their tarsi. Pile light golden everywhere except for posterior black fringe on the distal half of the middle femora, all of the apical fourth of hind femora, their tibiae and the dorsal surface of their tarsi. **Wings:** hyaline, the stigmal cell quite clear.

Holotype: one female, Rio Branco, Amazonas, Aug. 28, 1924.

Planes vagabondans n. sp.

Male. Length 9 mm. **Head:** front, cheeks and all of the face except immediately above the epistoma blackish. The antennae are dark brownish-black, the third joint at least twice as long as wide, the arista light brown. **Thorax:** mesonotum dully shining black with a faint brassy tinge and viewed in the proper light with a pair of wide, widely separated stripes of short yellow pile. There is a similar stripe along the transverse suture and another sublaterally on the

posterior part of the mesonotum, all of which are connected. Humeri, pleurae and scutellum greenish black, the latter short yellow pilose, a few black hairs on its margin and pair of slender pale bristles. **Abdomen**: entirely dark, the first and second segments chiefly opaque black, the third and fourth segments strongly metallic greenish-black, the third segment in the posterior half with a pair of large, narrowly separated, blackish triangles. **Legs**: shining black, all of the tibiae brownish black except their narrow basal fourth which is pale yellow. Last three joints of first and second tarsi and all of hind tarsi black. Hind tarsal pile pale except on the upper surface of the last three joints. Hind tibiae very massively thickened. **Wings**: strongly and diffusely tinged with brown, somewhat paler on the posterior half.

Holotype: one male, Restrepo, Columbia, (J. Bequaert, collector).

A NOTE ON STRYMON ALCESTIS (EDW.)
(Lepidoptera: Lycaenidae)

This species which is still quite uncommon in Collections was first recorded in Kansas from Sumner County in June of 1938. Two specimens, a fresh male and a fresh female were taken that year. None were observed in 1939. In 1940 during the last two weeks of June and the first two weeks of July, hundreds of this butterfly were observed in Sumner County, Kansas. (Over 200 specimens captured in one day.)

Perhaps the reason this butterfly is considered rare is because it seems to be very gregarious. The above numbers observed were found in two colonies. In each case the headquarters for the colony was a hedge row which faced north onto a field of alfalfa. In no case was a butterfly found on the bloom of the alfalfa more than 30 yards from the hedge trees. They would feed on alfalfa and then return to the leaves of the hedge trees to rest and were very conspicuous on the upper surface of the leaves.

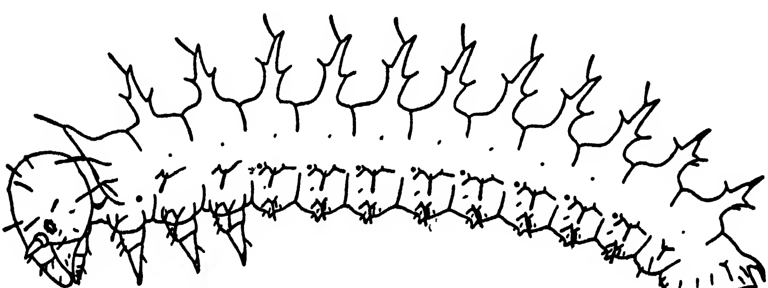
DON B. STALLINGS, Caldwell, Kansas

DESCRIPTION OF THE LARVA OF BITTACUS APICALIS AND A KEY TO BITTACID LARVAE (MECOPTERA)

L. R. SETTY, Park College, Parkville, Mo.

The larva of **Bittacus apicalis** (black-tipped hanging-fly) has been obtained by the writer from eggs that were kept through the winter. The description is as follows:

Length of one day old larva 3 mm.; width, 64 mm.; width of head capsule, 48 mm. Length of young second instar, 5 mm.; width, 96 mm.; width of head capsule, 65 mm. Body eruciform type and slightly arched upward. Segmentation distinct. Head hypognathous. General body color brownish-gray; head brown. Anterior margin of pronotum with three dorso-cephalad seta-bearing protuberances on each side. Most of the body segments with a pair of elongate dorsal protuberances; **each protuberance** (except in prothoracic and last three abdominal segments) **with a filiform seta a short distance below its distal end** (seta at distal end of protuberances in first instar) and with two small seta-bearing protuberances on its surface. The dorsal protuberances on the thorax frequently with soil packs and surface of body with thin film of soil. Dorsal protuberances of the eighth and ninth abdominal segments terminating in a peg-like seta and with three small seta-bearing protuberances on their surface. Tenth segment with but a single median protuberance bearing a peg-shaped seta. Each side of nearly all body segments with a lateral protuberance bearing three setae; ventrad of each lateral protuberance, a small one with three setae. A spiracle present on each of the first eight abdominal segments cephalad of main lateral protuberance; one larger spiracle near caudal margin of each side of prothorax. Prothoracic legs closer together than those of meso- and meta-thorax. One pair of prolegs on the first eight abdominal segments. Last abdominal segment with protrusile sucker around anus. Antennae short. Group of seven ocelli caudo-dorsad of each antenna; one ocellus at the anterior end of the coronal suture. Man-



dibles dark brown at distal end.

See the accompanying figure of a lateral view of the second instar of **Bittacus apicalis.**

Nine species of hanging-flies are known for North America. Up to date the larvae of six of these have been seen by the writer. The following is a key to the larvae.

A. Seta arising at apex of most of the dorsal protuberances in all instars.

B. Seta at distal end of most of the dorsal protuberances clavate.

C. Dorsal protuberance as long as the height of the segment proper in first instar; one pair of small blunt protuberances covered with small spines on caudal edge of dorsum of most of the abdominal segments in older larvae ---------------**B. pilicornis**
(Hairy-horned hanging-fly)

CC. Dorsal protuberance not as long as the height of the segment proper in first instar; no protuberances present on caudal edge of dorsum of abdominal segments in older larvae ---------------**B. occidentis**
(Western hanging-fly)

BB. Seta at distal end of most of the dorsal protuberances filiform (or nearly so).

C. Dorsal protuberance nearly as long as the height of the segment proper in young larvae.

D. Anterior margin of pronotum with three dorsocephalad seta-bearing protuberances on each side (the most lateral protuberance with a very small seta-bearing one attached on its base in older instars) ---------------------------**B. strigosus**
(Striated hanging-fly)

DD. Anterior margin of pronotum with four dorsocephalad seta-bearing protuberances on each side (the most lateral protuberance being smallest-- ------------------------------- **B. stigmaterus**
(Say's hanging-fly)

CC. Dorsal protuberance not as long as the height of the segment proper in young larvae ------ **B. punctiger**
(Brown-spotted hanging-fly)

AA. Seta arising a short distance below the distal end of most of the dorsal protuberances in all instars (except the first) ---------------------------------**B. apicalis**
(Black-tipped hanging-fly)

ADDITIONAL NOTES ON CALYCOPIS CECROPS (FABRICIUS) AND CALYCOPIS BEON (CRAMER) (LEPIDOPTERA-LYCAENIDAE)

WILLIAM D. FIELD, Lawrence, Kansas*

Calycopis beon (Cramer) has just recently been recorded by the present writer as new to the United States.[1] Additional material of C. **beon** from Texas and of C. **cecrops** from Florida, has caused the writer to somewhat alter his concepts of the two species. As can be seen by studying the following descriptions or by studying specimens from the two regions, **beon** and **cecrops** are very closely related and might be better regarded as subspecies. Pending a careful study of the entire genus, however, the writer continues to recognize them as distinct species.

Calycopis cecrops (Fabricius)

Hesperia cecrops Fabricius, Ent. Syst., 3, (1), p. 270, 1793.

Rusticus poeas Huebner, Samm. Ex. Schmett., 1, pl. 101, fiigs. 1, 2. 3. 4, (1811).

Male.—Wings above, normally entirely brownish black or fuscous. Very rarely there is a faint suffusion in interspaces Cu_1 and Cu_2 of hind wing. When this occurs there are fucous, lunular-shaped submarginal spots, one each in interspaces Cu_1 and Cu_2 of hind wing. These spots are outlined by the faint blue suffusion, described above, and the marginal bluish white line found on outer margin of hind wing below vein Cu_2. Interspaces 2nd and 3rd A are greyish blue in specimens with blue suffusion present, otherwise they are of the normal ground color. There is a small red spot on anal angle of hind wing that is joined above by a small white spot.

The fringe of outer margin of both fore and hind wing is composed of long scales of dirty brownish white and on the uppersurfaces there is a heavy row of shorter overlapping scales of fuscous. Below vein Cu_2 of hind wing to vein 2nd A, in addition to the short fuscous scales, there is a row of extremely long fuscous scales and at end of vein 2nd A a group of long white scales. Along the inner or hind margin of fore wing the fringe is fuscous and on the same margin of hind wing a dirty brownish white. The tip of tail Cu_1 and Cu_2 is fringed with white. There are also some white fringe scales along the base of lower side of tail Cu_2. There are numerous long fuscous hairs in discal cell and interspaces Cu_1, Cu_2, and 2nd A of hind wing and also a small patch of white hairs along the end of vein 2nd A on this wing.

*Contribution from the Department of Entomology, University of Kansas, Lawrence.
[1]Bull. Brook. Ent. Sec., Vol. XXXV, No. 4, p. 134, Oct., 1940.

The wings underneath are drab or hair brown in color. There is a narrow bar of red across the distal end of discal cell in both fore and hind wing. These bars are faintly outlined along their outer sides by a line of brownish white. A wide submesial irregular band of red crosses the hind wing from about outer third of fore margin to abdominal margin just above the anal lobe. In the fore wing this same band crosses wing from costal margin of fore wing to outer third of vein Cu_2. This band is about one millimeter wide in fore wing and only slightly wider in hind wing. This band in both fore and hind wing is outlined on the outer side by an irregular double line of black and white. This black and white line, between abdominal margin and vein M_3 of hind wing forms an irregular connected V and W shaped marking. There is a black marginal line around outer margin of fore and hind wing and on inner side of this line in lower two-thirds of hind wing a marginal white line. The anal lobe is black with a small white spot above. Between this and the submesial band, described above, there is a thin tri-colored bar of orange, black and white. In interspace Cu_2 of this same wing there is a large submarginal lunule of greyish blue. Above this submarginal greyish blue lunule there are two large submarginal black spots, one each in interspaces M_3 and Cu_1, the one in interspace Cu_1 being many times larger than the one in interspace M_3. A third black spot is found in interspace M_2 but it is very small and faint. These three black spots and the blue lunule are capped above by thin curved black bars that continue on to fore margin of hind wing and continue in fore wing as faint straight fuscous bars above vein Cu_2. Between these bars and the black submarginal spots in interspaces M_2 and Cu_1 of hind wing the ground color is sometimes faintly tinged with red or orange. These same bars are outlined on their inner sides very faintly with white in interspaces M_2, M_3, Cu_1 and Cu_2 of hind wing.

Female.—Wings above brownish black or fuscous with a distinct blue suffusion in base of fore wing and throughout discal cell, basal third of interspaces M_1 and M_2, basal two-thirds of interspace M_3 and basal three-fourths of interspaces Cu_1 and Cu_2 of hind wing. Base of interspace 2nd and 3rd A a greyish blue color. In some specimens the blue suffusion of wings is entirely lacking or greatly reduced. There are two submarginal fuscous lunular-shaped markings, one each in interspace Cu_1 and Cu_2 of hind wing and sometimes a third such marking in interspace M_3 of this wing. These fuscous markings are outlined on their inner sides by the blue suffusion, described above, and on their outer sides by a bluish white marginal line that starting at vein M_1 runs around the margin from there to vein 2nd A. The anal lobe is red with a small white spot just above.

Fringes and undersurfaces of the female are as described for the male.

Variation.—Specimens from Missouri are sometimes intermediate between C. **cecrops** and C. **beon.** Dr. A. E. Brower kindly supplied the following notes on a number of specimens of **cecrops** from Willard, Green Co., Missouri. One of his males has the marginal black spots on interspaces M_3 and Cu_1 below, "broadly and heavily margined with red, (much more so than the anal spot)." Two of his males have the red spots in this region equal in size to the red spot found above the anal lobe; and one of the latter has the submesial band of red in the fore wing much narrower than usual. This specimen is also supplied with a considerable blue suffusion in interspaces Cu_1 and Cu_2 of the hind wing above. Two of his males have the whole lower half of the hind wings above suffused with blue, like the female, but not extending to the base. Another male, probably an aberration, is described by Doctor Browner as follows: "The red band on underside of primaries is strongly angled and narrow. On the secondaries the red band is narrower, more zig-zag, and nearly broken in the middle. The marginal area is strikingly different from that of other specimens, due to a prominent scalloped submarginal dark band with only the anal spot and a slight blue shade above it showing."

Distribution notes.—This species is found from Florida north to Maryland and West Virginia and west to Missouri and Louisiana. The writer has studied specimens from Okefenoke Swamp in Georgia, Hudson, Ceday Keys, Miami, Holywood, De Land, Lake City and Sanford, Florida, from Roaring River, Missouri and Caddo Park, Louisiana.

Calycopis beon (Cramer)

Papilio beon Cramer, Pap. Ex., 4, pl. 319, figs. B, C, 1782.

Thecla janeirica Felder, Verh. Zool. Bot.—Ges., 12, p. 474, 1862.

Tmolus isobeon Butler & Druce, Cist. Ent., 1, p. 108, 1872.

Thecla caulonia Hewitson, Ill. Diurn. Lep., p. 188, pl. 75, figs. 587, 588, 1877.

Thecla vibulena Hewitson, Ill. Diurn. Lep., p. 190, pl. 76, figs., 599, 600, 601, 602, 603, 1877.

Thecla bellera Hewitson, Ill. Diurn. Lep., p. 194, pl. 77, fig. 618, 1877.

Thecla bactra Hewitson, Ill. Diurn. Lep., p. 194, pl. 77, figs. 619, 620, 1877.

Male.—This species is similar to **cecrops** but differs in a number of particulars. The wings above are fuscous with a distinct blue suffusion in hind wing, along lower edge of interspace M_3 and throughout interspaces Cu_1 and Cu_2 except for large submarginal black lunules

in these last two interspaces. The marginal bluish-white line, anal red and white spot and fringes around outer and inner margins of the wings are as described for **cecrops**. In a series of some forty males of **beon** before the writer only a single specimen lacks this blue suffusion. It is interesting to note that in twenty male specimens of **cecrops** before the writer all were completely fuscous except two specimens that had a faint blue suffusion in hind wing.

Wings below are drab or hair brown in color as in **cecrops** but differ a great deal in the maculation. In **beon** the narrow red bars closing the discal cells are entirely gone or only very faintly indicated. The irregular red band crossing the hind wing from about outer third of fore margin to abdominal margin just above anal lobe is much narrower than in **cecrops** being less than a millimeter in width and becoming even narrower toward fore margin of hind wing. In the fore wing this line is even more greatly reduced, being no wider than the accompanying black and white line found along its outer side. The irregular, connected V and W shaped marking between abdominal margin and vein M. of hind wing is also present in **beon** but the middle section of the W is more sharply angled and the triangle between the V and W is entrely red, whereas in **cecrops** this triangle is the same color as the ground color or is sometimes covered with a few scattered red or orange scales. In **beon** the red above black anal lobe is more distinct, encroaching slightly upon the greyish blue sub-marginal lunule of interspace Cu_2. The marginal black and white lines of hind wing are as described for **cecrops**, however, submarginal markings present in **cecrops** are lacking or only faintly indicated in **beon** above vein M_3 of hind wing and in fore wing. Submarginal black spots of interspaces M_3 and Cu_1 are very distinct but are greatly reduced in size from those described for **cecrops** and are normally capped above by large, distinct red or orange lunules that are lined on their inner sides with distinct but thin black bars.

Female.—Differs from male of **beon** in having a larger blue suffusion on wings above, this blue extending through discal cell of hind wing and into base of fore wing. Differs from **cecrops** female in having much smaller submarginal black lunules in interspace M_3, Cu_1, and Cu_2 of hind wing above. Fringes and undersurfaces are as described for the male, the female differing from female **cecrops** in same ways as male **beon** differs from **cecrops**.

Distribution Notes.—This species is found from southern Texas south through Mexico and Central America into Brazil. The writer has studied specimens of **beon** from Donna, San Antonio, Concan, Progreso, Maud, Sequin and Brownsville, Texas and from Huichihuayan, San Luis Potosi, Mexico.

A BIOLOGICAL NOTE ON THE MANTISPIDAE (NEUROPTERA)

DOROTHYDEAN VIETS, Lawrence, Kansas*

For some time it has been known that these rather rare Neuropterous insects are "parasitic"[1] in the egg sacs of large spiders. However, the exact method by which the young mantispids enter the egg sacs, and the stages therein have long been a puzzle. Working with **Mantispa interrupta** Say at the University of Michigan Biological Station,[2] Cheboygan. Michigan, I succeeded in rearing one specimen to adulthood.

During the summer, twelve adult mantispids were taken, which I paired off in small screen cages, giving each a housefly and a few drops of water daily. Of the six females taken, two mated in captivity, both appearing with white masses attached at the tip of the abdomen. I dissected off one of these spermatophore-like structures, but found no evidence of spermatozoa. The female survived the operation and six days later laid a batch of 1800 eggs, which proved to be fertile.

The eggs are cream-colored, stalked on a thin pedicel, and laid in characteristic waves. After four or five days the eggs appear rosy to the naked eye, and a microscope reveals brownish bands on the dorsal side.

The larvae are about 1 mm. long, of a campodeiform shape, and, at first, seem to be gregarious. The young mantispids seem to ignore the presence of spider egg sacs, and when placed in an opening in one, they promptly crawled out.

However, when a female spider was placed in association with them, they seemed to congregate about her, and crawled over her body. The area between and around the spinnerets seemed to be preferred by the larvae.

At this point, the life history of the mantispid apparently is prolonged or shortened depending on the spider's production of an egg sac. After fifteen days several young mantispids were found alive on the body of a lycosid spider, and at this time she formed her egg sac.

During the formation of the egg sac, the young larva enters the sac, perhaps woven into it as the silk is spun. It has been suggested that, within the egg sac of the spider, the larva undergoes a change in form, thus being an example of hypermetamorphosis.

When developed, the pupa makes a hole in the egg sac, crawls out, and the mantispid emmerges. In the one specimen that came

*Contribution from the Department of Entomology, University of Kansas.

[1]That is, the larvae feed on the eggs of the spider.

[2]Under the Ida M. Hyde Scholarship from the University of Kansas.

through, the adult emmerged from the pupa case, but failed to expand its wings, and consequently died still clinging to the pupal case.

A brief summary of the complete life cycle: The adults mate and the spermatophore-like structure appears on the female, and again disappears within twenty-four hours. This structure is probably transferred from the male to the female during the mating process. One week later the eggs are deposited. Two of the females laid single batches of eggs: 1800 in one and 1600 in the other. Another female laid two batches of eggs, 800 in the first, and 550 in the second. According to Hungerford (1936), one female laid nine batches of eggs, a total of 8385, over a period of two months. The eggs hatch in two weeks; the larvae lived, in this one particular case, for fifteen days on the exterior of the spider, thus practicing a very necessary phoresy. The stages within the egg sac, that of larva and pupa combined, lasted thirty-eight days, with the adult emmerging two months and five days after the eggs were laid.

LITERATURE CITED

Hungerford, H. B. 1936. The Mantispidae of the Douglas Lake, Michigan Region with some biological observations. Ent. News, Vol. 47, pp 69-72 and 85-88.

——— 1939. A note on Mantispidae. Bull. Brook. Ent. Soc., Vol. 34, p. 265.

Merti, Carlos. 1940. Contribucion al Estudio de **Mantispa decorata** Erd. (Neuroptera). Rev. Soc. Ent Argentina, Vol. 10, pp. 304-307

Milliron, H. E. 1940. The Emmergence of a Neotropical Mantispid from a Spider egg sac. Ann. Ent. Soc. Am., Vol. 33, pp. 357-360.

Smith, R. C. 1934. Notes on the Neuroptera and Mecoptera of Kansas with keys for the identificaion of species. Journ. Kans. Ent. Soc., Vol 7, pp. 120-145.

AN INTERESTING ABNORMALITY IN RANATRA QUADRILENTATA STAL

A specimen from Jalisco, Mexico has been encountered which has a left middle tibia ending in two normal claws without any indication of a tarsus. This tibia measures 10 2/3 mm., whereas the other normal tibia is 13 mm. and has the tarsus of normal size and shape.

LOUIS KUITERT

AN ASCALAPHID LARVA NOTE

An Ascalaphid larva was found under the edge of a rotten stump near Eudora, Kansas, (Douglas County), on March 30, 1941. Since the larva was large it is evident that it had wintered as such. Two species of Ascalaphidae are reported for Kansas. Adult of **Ululodes macleayana hageni** Van der Weele have been taken in Douglas County, Kansas.

FRED TRUXAL and PHILIP JENKINS

ABERRATIONS FOUND IN KANSAS. (LEPIDOPTERA)

Papilio cresphontes ab. forsythae (Gunder). A single specimen of this aberration was taken by the writer several years ago in Labette County, Kansas. It has not been previously recorded from Kansas.

Zerene caesonia ab. stainkeae (Field). A single specimen was taken in Sumner County, Kansas by the writer on May 5th, 1940.

Zerene caesonia ab. immaculescunda (Gunder). Several specimens were taken in Sumner County, Kansas by the writer on April 15, 1938.

Euptoieta claudia ab. albaclaudia (Field). Eight specimens were taken in Sumner County, Kansas between April 14th and 28th, 1940 by Dr. J. R. Turner. It has not been previously recorded from Kansas.

Euptoieta claudia ab. fumosa (Field). Two specimens were taken in Sumner County, Kansas on June 16th, 1940 by Mrs. Stallings.

Junonia coenia ab. schraderi (Gunder). One specimen taken in Sumner County on Aug. 31st, 1940 by the writer.

Phyciodes tharos ab. reaghi (Reiff) One specimen taken by the writer in Sumner County, Kansas on April 15th, 1939. Technically this probably is not **reaghi** (Reiff) as it was taken in copulation with a normal male of **Phyciodes tharos f. marcia.** (Edw.). Both were the spring form. This has not been previously recorded from Kansas.

Strymon melinus franki ab. meinersi (Gunder). A single specimen was taken by Dr. R. C. Turner, Jr., in Sumner County, Kansas on Sept. 25, 1940. The same technically may be raised here as in the preceding aberration. This aberration was found in the subspecies **franki** (Field) while the original description applied to an aberration of the typical subspecies. This has not been previously recorded from Kansas.

DON B. STALLINGS, Caldwell, Kansas

REPRINT PRICES

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

Pages	1-2	3-4	5-8	9-12	13-16	17-20	21-24	25-28
50 copies	$1.10	$1.40	$3.85	$5.25	$7.45	$ 9.65	$11.85	$14.05
100 copies	1.40	1.65	4.15	5.80	8.00	10.20	12.40	14.60
200 copies	1.65	2.20	4.95	7.15	9.35	11.55	13.75	15.95
100 Add'n'l	0.55	1.10	2.20	3.30	4.40	5.50	6.60	7.70

Tables—for setting up—$1.25 per page extra.

Covers, per 100—$2.50

Fifty copies of reprints are free to the authors provided at least 50 copies are purchased. Reprints should be ordered in lots of 50 or multiples thereof.

Postage or express charges on carriage of reprints are extra

PRICE OF BACK VOLUMES

Volume 1 ....$2.00
Volumes 2 to 7 inclusive 1.00
Volumes 8 to date 1.50

Subscriptions for back volumes or numbers should be sent to the Secretary-Treasurer, Entomology Department, Kansas State College, Manhattan, Kansas.

CONTENTS OF THIS NUMBER

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

A quarterly journal published in January, April, July and October devoted to Entomology in the Western Mississippi Basin and the proceedings of the Kansas Entomological Society.

Manuscripts for publication may be sent to any of the publication committee.

The Kansas Entomological Society does not make exchanges since the Society does not maintain a library.

Subscription to the Journal must be paid in advance. The subscription rate is so low that second notices are not ordinarily sent out.

Payment of Canadian or other foreign subscriptions and bills must be made by international Postal Money Order or by a draft on a New York bank and payable in U. S. A. dollars.

Subscribers are urged to give us their full cooperation in these matters.

Subscriptions should be sent to the Secretary-Treasurer, Entomology Department, Kansas State College, Manhattan, Kansas.

Subscriptions in the U. S. A.,	**$1.50 per year**	**Single Copy**
Canadian or foreign subscriptions,	**1.75 per year**	**60 cents**

Volume 14, No. 2, April, 1941

VOL. 14 JULY, 1941 NO. 3

Journal

OF THE

Kansas Entomological Society

JAMES WALKER McCOLLOCH
1889-1929

Entered as second-class matter June 7, 1939 at the Post Office at Manhattan, Kansas, under the Act of August 24, 1912

Kansas Entomological Society

Volume 14 July, 1941 Number 3

THE ROLE OF PLASTICS IN THE FIELD OF ENTOMOLOGY

DON B. WHELAN, University of Nebraska

One need only to look around him to know that we are entering, if not well into, the Age of Plastics. More and more products of synthetic plastics of various kinds are appearing on the markets constantly. Recent progress in this field is due to the development of new types of resins, from which plastics are made, and to new applications for older plastics. In many instances plastics have supplanted glass, ivory, china, rubber, metal, wood and cloth, in industry and in arts, as well as for every day use in the office and in the home. The development of resins has been partly due to the diminishing supply of the products of nature and partly because these natural products lack certain essential qualities which industry demands. The endeavor of the chemist is not only to imitate natural substances but to improve on them. As yet there is no perfect plastic material but, gradually, the chemist is overcoming their deficiencies. Most manufacturers want a resin having a higher melting or softening point than is found in most of the present plastics and one that has a hard lustrous surface which will resist shock, wear and abrasion. With this they want greater mechanical strength, resistance to water, heat, the weak alkalies and acids, and nonflammability. Of course the absence of objectionable odors and the presence of pleasing colors is often desirable.

No general or complete article, dealing with this subject, can be written which represents the last word in the rapid progress in this field since new discoveries are constantly improving old formulas and new ones are being developed. Perhaps, before this article appears in print, several plastic resins which, heretofore, have had but limited uses may be in great commercial demand due to improvements in the chemicals used or in slight changes in the manufacturing processes. Each new modification adds to the number and variety of its uses.

The exhibits at the San Francisco and New York World Fairs showed many interesting uses for plastics. They are finding a multitude of uses in public buildings, in the construction and adornment of homes, as well as in air, steamship and railroad transportation. These latter find that plastics are lighter in weight, durable in service, lower in cost and attractive to the eyes of the traveling public.

In giving the characteristics of any plastic one must take into consideration its chemical nature, its method of manufacture, whether used alone or with fillers, and many other things. Changes can be made in the specific gravity, hardness, and some of the other characteristics of the plastic substances by altering the time or method of cure. In the following discussion of the different kinds of plastics, they are considered without the use of fillers or reinforcements of any kind although some reference will be made to such fillers.

Before discussing this subject it might be well to explain the meaning of several terms used in the plastic trade in non-technical language. A plastic material is a combination of organic compounds which, under the influence of heat and pressure, becomes sufficiently soft to permit forming to shape. A resin is a synthetic or artificial gum made from chemicals. In molding plastic articles, the manufacturer uses materials that are thermoplastic, thermosetting or cold molded. Thermoplastic, or heat softening materials, are those which are softened under the action of heat and pressure, without a chemical change taking place, and then chilled before removing from the mold. Once cooled, they retain their shape unless subjected to temperatures which again bring them to the softening stage. These temperatures will vary with the different materials from 130° to 180° F., or even higher, with some of the more recent plastics. Thermosetting, or heat hardening, materials are originally thermoplastic but when heat is applied it brings about a complete chemical change. Once cooled they become a homogeneous, insoluble mass incapable of being shaped again by heat. In the cold molded process, soft, powdered materials are subjected to great pressure at room temperatures and later cured in heated containers. These are grouped into three classes depending on the kind of binders used, namely those using bitumen, cement or resin. The cheapness of cold molding is its principal advantage and so it is used with low-cost binders.

Plastic products vary in the manner in which they are molded. Formerally most of the items were from compression molds but a newer development is injection molding where the preheated plastic material, or resin, is squirted into dies, or molds, under direct pressure and instantly cooled before being ejected.

The coal-tar resins are very important ones in the plastic industry because of the plentiful supply of the raw materials, their hundreds of beautiful colors, adaptability and freedom from deterioration by many of the chemicals.

Phenol-Formaldehyde Resins (Resinoids): These thermosetting plastics are made from phenol and formaldehyde and are usually black, brown, or the darker shades of red, blue and green. The darker shades of color result from the fact that phenolic materials

in their liquid state are amber in color. The molded variety of this plastic contains fillers, such as wood flour, asbestos, minerals or fabric. The cast resins usually do not contain fillers but are cast in lead molds and allowed to cure instead of being molded with steel dies under pressure. First the materials are heated in a kettle, poured into hand ladles and from them into a series of lead molds. Such castings can be ordered from the factory in the form of sheets, rods or tubes.

In its finished form this plastic is non-inflammable, odorless, tasteless, and when properly treated, is one of the most beautiful of all the plastics. It has a luster and depth of color that give it the effects of fine minerals and precious stones. It has about the same machining characteristics as brass or wood, absorbs little moisture, resists alcohol, oils and common acids. Among the more common uses for this type of plastic are: knobs and handles on autos, book ends, games, clocks, cameras, knife handles, lamp bases, pen sets, phonoghaph records, dental plates and a score of others. Their heat resistance is shown by their use as heater plugs, cooking utensil handles and permanent wave machines. Because of their hardness they can be used for football cleats, silent gears, etc. Other plastics are used for the lighter pastel shades of water-white colors.

Polystyrene: This comparatively new thermoplastic material is made from styrene and the purity of the latter influences the properties and behavior of the plastic. Light, high temperatures, and the presence of certain catalysts cause the transparent, colorless styrene to thicken and polymerize into a hard transparent resin. Chemically this plastic has a long chain of single styrene molecules. Rapid polymerization results in many short chains while slow polymerization gives fewer but longer chains. They are similar but differ in strength when molded. Polystyrene has excellent insulating qualities, the highest of any available synthetic resin and can be used in place of hard rubber, celluloid, ebonite, vulcanite, wood or glass. It has remarkable high shock-resistance and is stronger than the phenol-formaldehyde resins. Among its outstanding characteristics are its crystal-like clarity, its hardness, low water absorption and its resistance to alcohol, strong alkalies and acids. It has a specific gravity of about 1.06, refractive index of 1.50 to 1.75 and a transverse tensile strength of about 6000 pounds per square inch. It has been used for gift boxes, dishes, and many other outlets are being found for it.

Cellulose Plastics: While cellulose plastics can be made from wood, the most important base for the manufacture of nitrocellulose is cotton. From this material the industry produces most of the cellulose plastics.

Cellulose nitrate (celluloid and pyroxylin): This was the first man-made plastic and was developed to take the place of tusk ivory in billard balls. It is a mixture of nitrocellulose and camphor. One finds a great variety of color shades, in transparents, translucents, apaques and variegated, which can be made to represent ivory, horn, tortoise shell, mother-of-pearl, onyx, quartz, marble, lapis lazule, semiprecious stones and rare woods.

This plastic is cheap, takes a high lustrous polish, does not warp, and is impervious to moisture. It has the disadvantage of being highly inflammable and the camphor gives it the "celluloid odor" that is objectionable under certain circumstances. One can purchase this product in sheets, slabs, rods and tubes, in about the same sizes as the cellulose acetate. Its uses are myriads being one of the first materials used in safety glass, colored fountain pen barrels and in photographic films. Also, it is used in toys, novelties, ping pong balls, toothbrush handles, combs, dental plates and transparent drawing devices. Strength and toughness is shown by its use in tool handles, mallet-heads, golf-club facings, and its workability in that it can be softened and stretched over wood to produce heels for shoes, toilet seats and covers.

Cellulose acetate: This is a comparatively new thermoplastic material made by treating cotton linters with acetic acid and acetic anhydride in the presence of a catalyst. When mixed with suitable plasticizers, pigments and dyes it is ready for the molding operations. While it supports combustion it burns very slowly. This plastic has unsurpassed strength and beauty, and its horn-like toughness, uniform texture and high luster make it ideal for many industrial and decorative uses. Because of its toughness and resilience it is well adapted to thin-walled products where other types of plastics are inadequate because of their brittleness. It is available in hundreds of colors from white, through the pastel shades to black, in clear shades or mottled and variegated designs. Any color that is originally fast will remain fast in this material. This plastic can be formed to shape by either compression or injection molding undergoing no chemical change in the process. It can be obtained in sheets, blocks, rods or tubes in various sizes, as well as in the molding powder. It is safer to use than the cellulose nitrate in places where it might come in contact with heat because of its slow burning qualities. Because of this fact it is widely used in photographic and moving picture films. Hundreds of uses have been found for it, especially in automobile steering wheels, handles and instrument panels, in colored telephones, door knobs and in other places where it is desired to withstand considerable wear. It has no odor or taste, is low in heat conduction and pleasant to touch.

Textiles (rayon) made from this substance will imitate silks and even surpass them in luster. It is uninjured by contact with vegetable and most mineral oils but strong acids and alkalies attack it. Cellulose ecetate costs more than glass by the piece but is much lighter in weight, there being about 21.6 cubic inches to the pound. Its specific gravity is about 1.3 and will withstand temperatures of 160° F. or higher.

Cellulose acetate butyrate (acetobutyrate plastic): The chemical origin of this plastic is related to that of cellulose acetate except that it is made from an entirely different cellulose ester. It is said to have all the advantages of both cellulose acetate and cellulose nitrate with practically none of their disadvantages. In moisture absorption it is about the same as the nitrate and about half that of the acetate. It flows freely as its critical temperature is reached, resembling metals in this respect. This means that a smaller amount of plasticizer is needed. This plastic is particularly suited for applications which require resistance to distortion under varying degrees of heat and humidity. Its specific gravity is about 1.2.

Ethyl cellulose: This is a thermoplastic material that is resistant to dilute acids and alkalies, to sunlight, heat and water. It has a low softening point, low flammability and its molded products have a hard, glossy surface together with good shock resistance. This plastic has limited uses as yet since it is still undergoing development and refinement.

Protein Plastics: Both animal and vegetable materials have been used as a base for plastics in a wide field of industry. Among the farm products that are being experimented with are soy beans, peanuts, corn and many others. In most cases they have not shown as much adaptibility as are found in some of the chemical materials. They are, however, being greatly improved and are finding a place in the building and automobile idustries.

Casein-formaldehyde Plastic: A good grade of rennent casein powder is mixed with water and colors are added if desired. This gummy mass is extruded under pressure through a heated nozzle into a rod, tube or ribbon. Sheets are made by compressing the rods while they are still warm or by cutting blocks of the material. After leaving the machine, this plastic is hardened and steralized by steeping in a dilute solution of formaldehyde. This process is followed by drying where the excess moisture is gradually removed.

The casein-formaldehyde plastic is completely non-inflammable and can be molded or worked with the ordinary tools. It is cheap to produce and takes a brilliant polish, being chiefly used for buttons, combs, knitting needles, auto fittings, as well as many ornaments. Hollow threads of this plastic have been produced which have the in-

sulating value of sheeps wool so that, if necessary, one could have suits and blankets made out of milk. Among its objectionable features is the fact that it absorbs moisture somewhat and is attacked by acids and alkalies.

Other Plastics: There are other types of plastics, developed within the past few years, that are proving to be very valuable.

Methacrylate Resin (plexoglas and lucite): Basically this plastic is made from air, coal and water. The resinous products are obtained by the polymerization of the esters of methacrylic acid. Depending on the manner of synthesis this material can be produced in varying degrees of hardness from soft, sticky semi-liquids to hard, tough, thermoplastic solids. The solid form possesses extraordinary colorless transparency, stability against aging and chemical resistance to many reagents. It has a high impact strength, low specific gravity (1.18) and is easy to form to a desired shape.

This plastic can be purchased in rods, tubes, sheets, or in the powder form. The rods come in various diameters and lengths up to 48 inches while the sheets come in thicknesses from 0.60 up to 2 inches. Tubes are made in various thicknesses, diameters and lengths.

The rods can be machined and manufactured into novelties, models, advertising signs, or in surgical and scientific instruments. These rods will transmit, or "pipe," 90 to 92 per cent of the light even if it is bent, in this respect resembling quartz. The optical properties of this plastic are such that it is used in spectacle lenses, magnifying glasses and protecting goggles. It is used for dental plates and in airplanes. Dozens of uses have been applied to this plastic and its possibilities are almost unlimited.

Among the more recent developments, using the plastic sheets or powders, is the embedding of insects, flowers and vegetables whereby they retain their natural shape and color for years without deterioration.

Urea-formaldehyde: This molded thermosetting plastic was developed principally to provide lighter colors than were available with the earlier produced phenol-formaldehydes resins. It is made from urea-formaldehyde resin, filler, pigments and plasticizers which, upon being heated, soften into a plastic mass that can easily be molded. These molds are kept dust-free and are usually made of stainless steel or are chromium plated to give a better finish to the product. After flowing for a few seconds the compound undergoes a chemical change and is converted into an infusible, hard, strong and insoluble form, taking its shape from the die. Usually after the finishing operations it is ready for use. The commercial product is available in a complete range of standard, color-fast shades, from natural colorless, and pure white, through the pastel shades and brilliant hues to jet black. A large number of translucent, semi-opaque and

opaque special colors are also available. In other words the range of colors is almost unlimited.

The finished plastic has a smooth, high luster that does not chip, rust or corrode. It is resistant to the common organic solvents, such as alcohol and acetone, also to the weak alkalies. Strong acids and alkalies do effect it. It is completely tasteless and odorless as shown by its use on tableware and kitchenware. This material can be tooled and is free from surface ar^ing. The natural, unpigmented compound is highly translucent, giving high light transmission with an exceptional degree of diffusions making it excellent for semi-indirect lighting fixtures. Hundreds of other uses are on the market, among them being: buttons, buckles, costume jewelry, as well as cases for radios, refrigerators, clocks and scales. The textile industry uses the emulsions of this plastic to make their product creaseproof.

Vinyl resins (Vinylite, Butacite, etc.): The most important plastic in this group of resins is made of a combination of vinyl acetate and vinyl chloride. They are produced as a white, fluffy powder which produces transparent, translucent or opaque articles in the most delicate of pastel shades. They have low moisture absorption and resist most chemical reagents. Articles molded from these resins do not warp, shrink or tend to distort. Records for transcribed radio programs are made of vinyl resins. They are lighter, stronger and less brittle than old shellac records formerly used. Other uses for this material are: bottle caps, poker chips, radio parts, airplane windows, flashlight lenses, and floor tile.

Past Uses of Plastic in Entomology: The plastics most generally used by entomologists, in the past, have been celluloid (cellulose nitrate), and cellophane (cellulose acetate complex). Both of these materials have been employed in the construction of insect breeding cages because they are light in weight, transmit most of the light rays, and the operator can easily observe the activity within the cage. Celluloid has an advantage in that it is rigid enough to need no supporting frame, soft enough that it can be cut or punched and because of its thermoplastic nature, can easily be warmed and shaped as desired. By softening with amyl acetate intricate cages or traps can be made. In some cases the "celluloid odor," due to the camphor in its preparation, has been a drawback in some kinds of experimental work. The cellophane is odorless and tasteless but so thin that it is usually used on a supporting frame of metal, glass or wood. Celluloid has been used for cyanide bottles, window in insect cages, deflector cones in light traps or for microscopic observation cages for small, living insects. Cellophane has been used to cover larval burrows so that one can watch developments and still keep out the air. Colored cellophane make excellent light filters, and have been used in light

traps. Cellulose acetate is advertised in Ward's Natural History Establishment catalogue for use in mounting tiny insects, or genetalia, between disks or on points.

Other plastic materials that have been used are methacrylate, cellucotton, cel-o-glass and masonite. The methacrylate has been used for substage illumination of microscopes as well as for magnifying lenses. Two reasons why plastic lenses have not been more generally used in optical and photographic equipment is their tendency to scratch easily and because they do not have the so-called "optical surface" without further grinding. Compression molded lenses are slower to make than those made by the injection method but they have a harder surface. Polystyrene and cellulose acetate are also being used for this purpose. The first two are preferred in the order mentioned while the latter is probably more shock resistant. Cellucotton has been suggested for packing and shipping insects and cel-o-glass for insect cages and for a part of the outside construction of insectries. Masonite has been used for spreading boards, cages, constant temperature cabinets.

Possible Future Uses for Plastics in Entomology: As mentioned earlier, plastics are slowly "supplanting glass, ivory, china, rubber, metal, wood, cloth, etc." in many of our industrial uses. In entomology they will compete chiefly with glass, rubber, wood, cloth and metal.

In competing with glass one will find that plastics cost more at the present time and are not as universely sold but they have advantages to offset this. Among these are their lighter weight, ease of shipping and lower freight rates, greater diversity of kinds, thicknesses, shapes and colors. They are easily fashioned into almost any desired shape and are resistant to shattering, rusting, chipping or corrision. In some cases they have taken the place of windows in buildings keeping out the weather and transmitting the ultra-violet light rays. Several of the transparent plastic materials, like cellulose nitrate, cellulose acetate and vinyl plastics are ideal for insect breeding cages on branches of trees, bushes, etc., where the weight of glass might be a limiting factor. On cages in the insectry their lack of weight might cause them to blow over, if not properly supported. However, there is little loss from breakage. Most of the transparent plastics will transmit ultra-violet rays and, with a multitude of colors to choose from, one can get almost any length of light ray in the chromic scale.

Wood is comparatively cheap, easy to obtain and can be worked by anyone with a few simple tools. Plastics would probably not compete with it for all general purposes but there are many places where they might prove to be superior, due to their elasticity, transparency, freedom from weathering, from attacks by bacteria, fungus

diseases or by insects. Where hundreds or thousands of simple articles are to be fashioned plastics might prove to be superior to wood for, once the mold is made, they can be produced cheaper and more accurately than when fashioned from wood. According to Modern Plastics, a fir woodflour plastic is used in the Northwest to fill worm-holes in otherwise sound and high-grade lumber. This plastic was developed in an attempt to salvage some of the fire-killed timber which was attacked by the round headed wood borers. This, or some other kind of plastic substance, might be forced into trees or other plants to determine he convolution of various insect burrows and help in a study of their habits.

Plastics compete with metals in many places because of their lightness, resilience, freedom from arcing and easier adaptibility. There are some kinds that are inferior to metals in rigidity, hardness of surface or other characteristics but the shortcomings of plastics are rapidly being removed by the chemist. Recently plastic window screens, made of vinylidene chloride, have been made which are non-rusting. This product may be very valuable in insect breeding work. Also it is available in a great variety of colors. Where non-metallic screens are needed this product will prove to be very welcome. Together metal and plastics are ideal in that plastics adhere well on metal surfaces and metal rods give the plastics the rigidity they might otherwise lack. A thin plastic film applied on metals through the medium of polyvinyl alcohol temporarly protects them from corrosion and tarnishing.

Rubber is ideal in many ways and for many things but plastic rubber (neoprene and vinylite), while more expensive, does the same work, does it better, and lasts longer without deterioration. It can be purchased in sheets or in tubing. Polyvinyl alcohol is also used for "rubber" tubing and gloves.

Cloth for cages, insect nets, etc., are continually being used by the entomologist. A new material, nylon, has been developed that is not only a substitute for the expensive imported silks but is an improvement on them. The entomologist may find many uses for this material in the future, in insect nets, cage material, or in graduated sieves.

Perhaps plastics will be at their best in displaying insects and their work to the public, in the museum as well as in the class room. Recently Dr. Charles E. Sando has developed a method of preserving insects, flowers and vegetables in transparent methacrylate resin, a process that does not effect their color. They are perfectly preserved and can be viewed from all angles without fear of breaking the specimens. One wonders if type specimens could be thus preserved to keep them intact for future generations. In preserving entomological material the specimen must be free from moisture

before insertion in the plastic preserving material. Urea-formaldehyde has also been used for this purpose and other resins, perhaps polystyrene, may be found to be adaptible for this purpose.

In beekeeping, plastics will no doubt play a part in the future. There is no reason why plastics cannot play a big part in the future manufacture of hives, frames and foundation. At the present time cost may be an item in delaying their use but, with injection molding, hive bodies can be made in one piece in any color desired and turned out on the quantity basis. Frames also can easily be produced, which, together with the hive will be termite and rot proof. Perhaps the phenolic resins will work best here while the foundation might be made of the vinyl resins.

Moulage: Another way that plastics can be used is by employing molds, making an impression of the object to be reproduced, in clay, plaster-of-Paris, or rubber latex. When the mold is ready the plastic can then be poured in to produce any desired shapes. For this purpose specially prepared phenol-formaldehyde plastics are probably best. A mixture of plastic resin and wood flour might work well where only small amounts of the material are needed, or even for making enlarged models of insects.

Reproducing Sections: In using a microtome to section an insect for the study of some internal cavity, structure, or other part, the operator can use thin sheets of transparent plastic to represent these sections greatly enlarged. By using a large series in parallel, and cutting them proportionately, the sections can be enlarged for study. The idea of depth can be shown in a series of sections by using transparent, opaque or colored sheets of plastic.

Some resins have been developed, and others may follow as the need arises, to act as a sticky barrier on trees to hinder the passage of insects. Plastic material can also be used to fill the body cavity of insects to keep their shape intact. It can be used on large-bodied insects such as Mormon crickets, tomato worms, cutworms, white grubs, and others.

Conclusion: The use of plastics in entomology has only just begun and the possibilities of their future use is only limited by the characteristics of the materials employed. New plastic substances are constantly being developed and the older one improved to fit some industrial use or to correct a weakness in those now on the market.

The entomologist will come to rely more and more on plastic materials for use in making exhibits showing insects and their work because, once made, they will last indefinitely. With chemical and physical qualities that can be incorporated as desired, plastics will be used for exhibit material in museums and in the class room. Also in cage materials for insect breeding work and in sections or

injection media by the anatomist. Even now plastic materials are far ahead of our ability to use them and at a very reasonable cost.

A Partial List of Manufacturers of Plastics

Following is a partial list of the leading manufacturers of plastic resins together with some of the plastic materials they produce. For brevity they are abbreviated: C-casein, CA-cellulose acetate, CAB-cellulose acetate butyrate, CU-cellulose nitrate, EC-Ethylcellulose, PF-phenol-formaldehyde, P-polystyrene, M-methacrylate, Mu-moulage, UF-urea-formaldehyde, VR-vinyl resins.

1. Aladinite Co., Inc., 261 Wallace St., Orange, N. J. (C).
2. American Cyanamid Co., 49 West 49th St., New York, N. Y. (PF, UF).
3. American Plastics Corp., 50 Union Square, New York, N. Y. (C).
4. Bakelite Corp., 247 Park Ave., New York, N. Y. (CA, P, PF, UF).
5. Carbide & Carbon Chemicals Corp., 30 E. 42nd St., New York, N. Y. (P, VR).
6. Catalin Corp., 1 Park Ave., New York, N. Y. (PF).
7. Celluloid Corp., 10 E. 40th St., New York, N. Y. (CA, CN).
8. Dow Chemical Co., 919 Jefferson Ave., Midland, Mich. (EC, P).
9. E. I. duPont de Nemouers & Co. Inc., Plastics Dept., Arlington, N. J. (CA, CN, M. VR).
10. A. Knoedler Co., Lancaster, Pa. (PF).
11. General Electric Co., Plastic Dept., 1 Plastics Ave., Pittsfield, Mass. (PF, VR).
12. General Plastics Inc., 710 E. Walck Rd., N. Tonawanda, N. Y. (PF).
13. Hercules Powder Co., 999 Market St., Wilmington, Del. (CA, CAB, CN).
14. Makalot Corp., 262 Washington St., Boston, Mass. (PF, UF).
15. Marblette Corp., 37-21 Thirtieth St., Long Island City, N. Y. (PF).
16. Monsanto Chemical Co., Plastics Division, Springfield, Mass. (PF, CA, CN, VR, P).
17. Nixon Nitration Works, 125 Murray Ave., East Nixon, N. J. (CA, BN).
18. Plaskon Company, 2124 Sylvan Ave., Toledo, Ohio. (UF).
19. Rohm & Haas Co. Inc., 222 W. Washington Sq., Philadelphia, Pa. (PF, M).
20. Technical Supply Co., Palo Alto, Calif. (Mu).
21. Tennessee Eastman Corp., Kingsport, Tenn. (CA, CAB).

BIBLIOGRAPHY

The bibliography on the manufacture and general uses of plastics is too long for incorporation here but a few sources of information on the subject are listed below:

Modern Plastics. Published by Breskin and Carlton Pub. Co., 122 East 42nd St., New York City.

Industrial and Engineering Chemistry. American Chemical Society, Easton, Pa.
Lockery, Andrew J. 1940. Plastics in the School and Workshop, 2nd ed. Governor Pub. Corp., New York, City.
Kline, G M. 1936 Organic Plastics Bureau of Standards, Cir. C411, Government Printing Office, Washington, D. C.
Ellis, Carleton. 1935. Chemistry of Synthetic Resins, 2nd ed., 2 vols. Reinhold Pub. Corp., New York City.
The Plastic Industry in America 1939 Supplement to Thomas Register of American Manufacturers, Thomas Pub. Co., 471 Eighth Ave, New York City.

THE OCCURRENCE IN KANSAS OF THE SUGAR-CANE ROOTSTOCK WEEVIL, ANACENTRINUS DEPLANTUS CSY., (COLEOPTERA, CURCULIONIDAE)*

HARRY R BRYSON, Kansas Agricultural Experiment Station**

L. E. Melchers and James Koepper of the department of Botany called the writers attention to insect injury to plants on July 26, 1939, in a row of Shantung kaoliang growing in a sorghum variety nursery used in sorghum smut investigations at Manhattan. Small white, grub-like, footless larvae with brown heads were found in the stalks and proved to be those of a small snout beetle. Pupae and adults were also found in the cavities within the stalks but no eggs were present.

About twenty larvae and pupae were reared to the adult stage out of 75 larvae and 15 pupae obtained from cavities in the stalks. Four adults were taken from the cavities where they had emerged from the pupae and only two beetles were found crawling on the exterior. Injury to an occasional plant no doubt would escape recognition unless the plants were removed and examined. An examination of barnyard grass near the nursery in 1939 and 1940 revealed the presence of the weevils but they were not as abundant as in 1937. A heavy infestation of the weevil was found by D. A. Wilbur and Roy Fritz, investigators at the Kansas Station, in barnyard grass in low areas along the roadside near Iola, Allen County, in July, 1940. A lighter infestation was observed about the same time in Franklin County. An examination of corn in a field adjacent to one of these infested areas did not reveal the presence of the beetles. Naturally, sorghum growers would be interested in the presence of barnyard grass if such a host relationship were established.

Host plants. The first observations of the injury caused by this insect were made April 28, 1910 by D. M. Van Dine at Berwick, Louisiana. A published account of the discovery was made by Hollo-

*Contribution No 501 from the Department of Entomology.

**This paper includes observations recorded under corn insect investigations supported by funds from project No. 9 Hatch.

way (1912). The insect was found to be a small weevil working in sugar cane below the surface of the soil. Barker found what appeared to be the same weevil working in sugar cane in a similar manner at Audubon Sugar Experiment Station, Hinds and Osterberger (1932). It was also reported from Donna and Brownsville, Texas.

These writers also point out that the weevils attracted little attention from 1912 until 1931 when a heavy infestation was in the stalks. The infestation at Manhattan was discovered late in the season after the insects had matured and had left the badly injured stalks. Specimens of the adults collected and reared were sent to the U. S. National Museum at Washington, D. C. where L. L. Buchanan identified them as one species of sugar-cane rootstock weevil, **Anacentrinus deplanatus** Csy.

OCCURRENCE AND DISTRIBUTION

Buchanan (1932) gives the distribution of the species as Washington, D. C., southern Illinois, South Dakota, Missouri, Kansas, Texas, Arkansas, Louisiana and Mississippi. Information given Osterberger and Hinds (1932) by A. F. Satterthwaite led them to conclude that the species, A. **deplanatus** Csy., is evidently the most commonly known species of this genus and that it is widely distributed from Louisiana to Kansas at least. D. A. Wilbur at the Kansas Station collected and reared several individuals from barnyard grass, (**Echinochloa crus-galli**) at Manhattan. These beetles were sent to Washington for identification along with those which the writer collected and reared from the sorghum plants.

Some of the beetles were reared from barnyard grass growing in the vicinity of the sorghum nursery in 1937 but no injury to sorghum plants in the nursery was observed at that time. Slight injury found on a sugar-cane plantation at Grandville, Louisiana, where there was a failure to get a stand of sugar-cane on 10 acres and damage occurred to the stand on 95 acres more. Furthermore, observations indicated that the insects were widely distributed over the cane belt. They also reported that in addition to the occurrence of the species on sugar-cane it had been taken from crowns of barnyard grass and bull grass **Paspalum boscianum**. The species was also found breeding to a limited extent in the roots of corn and sorghums. This is the first instance the species has been found causing injury to sorghums in Kansas, so far as the writer knows.

The weevils caused injury to several varieties of sorghums but the Shantung kaoliang plants were injured to the greatest extent. Injured plants were found in the rows in which hegaria, feterita, African kafir, Reed kafir, milos and milo crosses were grown. Larvae were found in the plants as late as September 5, 1939. None was

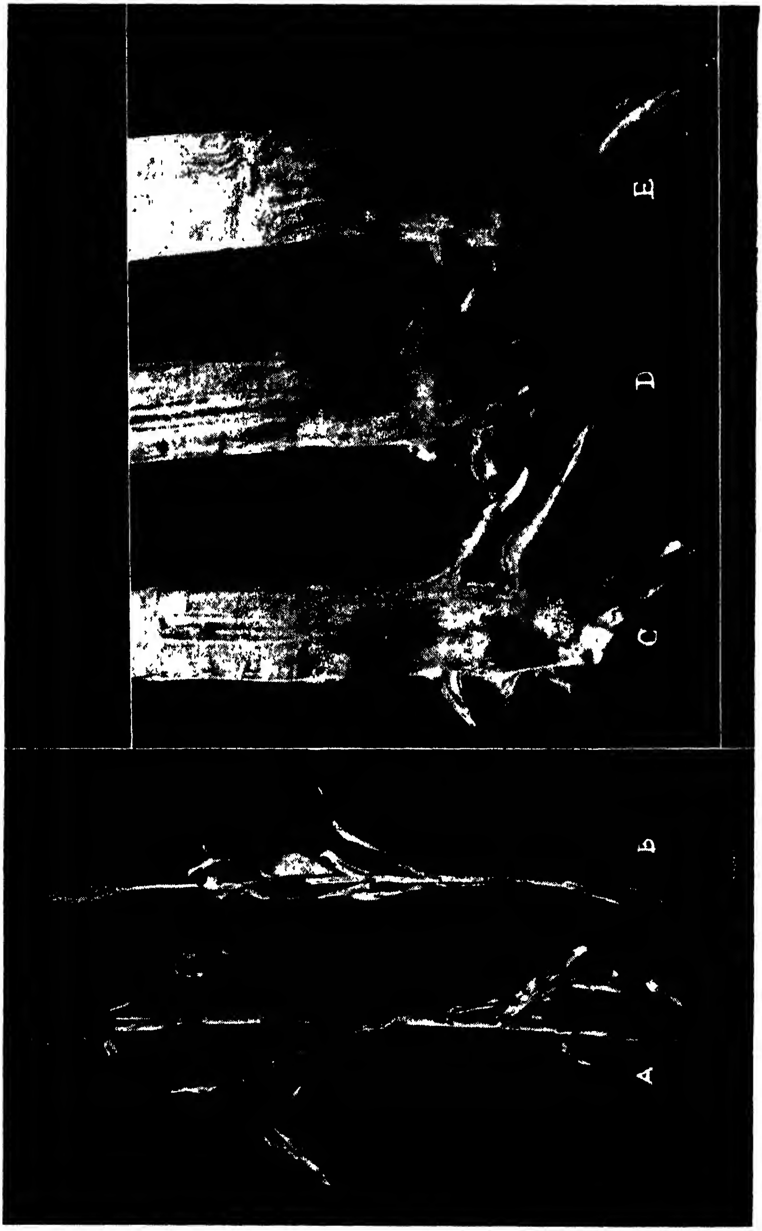


PLATE I

found in the Shantung kaoliang after August 25, 1939.

DESCRIPTION OF INJURY

The external evidence of injury to the stalks appeared late in the growing season and prior to the time for the sorghums to head. The leaves nearest the soil turned brown and took on the appearance of having been burned. Within a short time after the first leaves withered, the next higher ones up on the stalk began to die and shrivel slightly. This progressive dessication of the plant tissues continued until the entire plant became dry and brown. The seed which had formed failed to mature properly and all of the kernels were undersize.

The leaves did not shrivel to any great extent or drop from the plant. When the plant had an infestation of one or two larvae in the base of the stalk, considerable seed formed in the head. An infestation of four or more larvae destroyed the tissues to such an extent that very little if any seed was produced. Kernels formed were badly shriveled and immature. The stalks were so weak just above the surface of the soil that they lodged easily.

An examination of infested plants revealed small punctures on the exterior near the surface of the soil, which were surrounded by a purplish to brownish discoloration of the tissues. Lodged plants, when exposed to sufficient soil moisture, decomposed in much the same manner as did plants cut off and allowed to remain on the soil.

This evidence of injury was apparent from the middle of July until harvest. The majority of the injury to the stalks had been done prior to the middle of July. Attempts to remove the plants from the soil were usually unsuccessful because the stalk broke off at the surface, leaving a stub and the root system in the soil. In many instances, the roots were shriveled and showed marked signs of decay, which process continued rapidly after the plants lodged. It usually was necessary to use a spade to remove the plants with their root systems intact.

Naure of injury within the stalks. Stalks which were split open in order to determine the intensity of the infestation showed that the chief injury was caused by the larvae tunnelling cavities in the stalk

EXPLANATION OF PLATE I

A—An uninjured stalk showing normal root development, well developed head and green leaves.

B—A severely injured kaoliang plant showing shriveled stalk and leaves, a blasted head poorly developed roots.

C-D—Split halves of the same kaoliang stalk, showing characteristic cavities.
C—Larva in the cavity.
D—Pupa in the cavity.

E—Shows larva at work in a cavity, causing severe injury to the lower part of a stalk. Some root injury is also evident.

at or below the surface of the soil. Small egg laying punctures were also seen in the stalk.

The tissues within the cavities had been destroyed and removed completely. The greatest damage to the stalk apparently was done near the origin of the brace and permanent roots. Occasionally, the roots were damaged, but this type of injury did not occur except in badly infested stalks. Observations indicated that the larvae did not migrate from one cavity to another but consumed the tissues as they progressed. (Plate 1, C, D, E).

The cavities ordinarily are found most numerous in that portion of the stalk beginning about 2 inches above the surface of the soil and extending downward to the end of the tap root. Occasionally, the brace and feeder roots had been entered by the larvae.

The paired halves of the same stalk illustrates in "C" and "D" contained two cavities, the upper one occupied by a larva while the lower one contained a pupa. The cavity containing the larva was located approximately one inch above the surface of the soil, while the lower one contained the pupa, was just below the soil level. Examination of more than 100 plants indicated that there was a tendency for the larvae to move downward and to pupate in the portion of the stalk below the surface of the soil.

Often there is very little evidence on the exterior to indicate the amount of injury to the tissues within. The tissues near the bases of many of the plants were completely destroyed due to the convergence of two or more cavities. In such instances, the conducting tissues were severed so that normal physiological processes of the plant were checked entirely.

The color of the injured tissues was reddish-brown at the beginning, turning to dark brown at the time the larvae transformed to pupae. Some of the cavities measured three-eights of an inch in diameter. The internal injury, while confined to a localized region near and beneath the surface of the soil, occurred at a place where a small amount of damage to tissues results in almost a total loss of sustenance to the plant.

Other insects attacking sorghums in Kansas

The sorghums, when compared with corn, are relatively free from injurious insect pests in Kansas. The range in profitable production of certain varieties, however, may be limited by the presence of chinch bugs. Chinch bugs probably determine the boundry east of which milo and other varieties susceptible to chinch bug injury can be grown profitably. The development of atlas sorgo, a variety resistant to chinch bug injury, has made possible the extensive use of a valuable grain and forage sorghum in the eastern and southeastern part of the state where chinch bugs normally are abundant.

Probably the most important of the other insects attacking sorghums in Kansas are the kafir ant (**Solenopsis molesta** Say), corn leaf aphis (**Aphis maidis** Fitch.) and the corn ear worm (**Heliothis armiger** Hbn.). Somewhat less important pests are the grasshopper, chiefly **Melanoplus spp.**, maize bill bug (**Calandra maidis** Chittn.), sorghum webworm (**Celama sorgiella** Riley), Angumois grain moth (**Sitotroga cerealella** Oliv.), and the common stalk borer (**Papaipema nebris nitela** Guen.).

Hayes (1922) discussed the relative importance of insects attacking sorghum in Kansas. Swanson and Laude (1934) also called attention to the insects of importance in the production of sorghums in the state.

A majoriy of the cultivated crop plants used to replace the native grasses in Kansas belong to the grass family; consequently the insects which attacked the grasses of the old primary community were forced to turn to new crops planted by man, or perish.

Corn, wheat, sorghums, oats, rye, barley, and other cereals are attacked by insects which originally fed upon the native grasses. Many insects now infesting grasses may appear to be insignificant potential pests, but may become a menace to cultivated crops when ecological conditions favor their multiplication. It is evident that the sugar-cane rootstock weevil is capable of causing severe damage even in relatively few numbers. Its occurrence should be watched for and reported in order that control measures may be developed in case recurrence of the insect warrants it.

SUMMARY

1. **Anacentrinus deplanatus** Csy. one of the sugar-cane rootstock weevils has been found attacking sorghum in Kansas.
2. Infestation was greatest in Shantung kaoliang, feterita, hegari, milo, milo crosses, African kafir and Reeds kafir.
3. The manner in which it attacks the plant, and the amount of injury to the plant which one larva can cause, make the insect a possible potential pest.
4. Barnyard grass (**Echinochloa crux-galli**) is one of the native host plants for the insect. Additional host plants have not been studied in Kansas.
5. There are a few external evidences of injury prior to the time the stalks begin to lodge. Injured stalks have cavities excavated within, in which the eggs are laid, the larvae feed, pupate and transform to adults. The adults leave the stalks after they emerge.

LITERATURE CITED

Buchanan, L. L. A new Barine Curculionid injurious to sugar-cane in Louisiana with Synopses of Anacentrinus and Oligolochus (Coleoptera). Ent. Soc. Amer. Ann., 25: 328-336. 1932.

Hayes, Wm P. Observations on insects attacking sorghums.
Jour. Econ. Ent, 15. 349-355 1922.
Hinds, W. E. and Osterberger, B. A. Sugar-cane rootstock weevils.
Ent. Soc Amer. Ann., 25. 337-343. 1932.
Holloway, T. E. Insects liable to dissemination in shipments of sugar-cane.
U. S Bur. Ent, Circ. 165, p 3 1912.
Ingram, J. W. and Hollaway, T. E Injury to sugar-cane by a small weevil
Jour. Econ. Ent., 23: 832-833. 1930.
Laude, H. H. and Swanson, A. F. Sorghum production in Kansas.
Kansas Agr. Expt. Sta, Bul. 265. p 40-43 1933.

A NEW SPECIES OF THYREOCORINE FROM MEXICO

R. I. SAILER, Lawrence, Kansas*

Galgupha magna sp. nov.

General Charactaristics: Body broadly ovate, shining black, with distinct aeneous reflections; tarsi, beak and antennae fuscus, the latter two increasingly so distally.

Head produced one and one-half times length of eye beyond transocular line, front margin truncate to regularly rounded medially, lateral margin in front of eye straight to slightly convex. The vertex with area from occelli to apical half of tylus distinctly punctured, slightly rugose from that area to lateral margin on each side, tylus posteriorly and occipital strip with punctures faint if at all indicated. The pronotum with punctures on both anterior and posterior disc obsolete but becoming more evident laterally, quite coarse in area from eye to basal angle of scutellum. The scutellum with punctures most evident at basal angles producing a somewhat rugose area perpherally and on declivity lightly punctured, nearly smooth discally. The mesocorium and veins lightly punctured; sternites numerously punctate, tending toward smoother medially.

The sixth sternite in both sexes subangulate antero-medially and to a lesser degree sublaterally, more evidently so in male. The preceding sternites scarcely constricted medially; in female, medial length of sixth strenite equal to medial length of preceding two combined; in male, it is equal to combined length of preceding three sternites.

The ventral exposure of male hypopygium with scattered punctures. Its hind margin destinctly reflexed, slightly concave medially, a few hairs from dorsal surface visible in the concavity. The medial length of ventral exposure subequal to medial length of fifth sternite, width across posterior angles exceeding medial length of sixth sternite as 8.0 to 6.5.

The genital plates of female punctate. Their length as compared to medial length of sixth sternite as 3 to 5 and as long or longer than the postventer. Posterior margins oblique, varying from

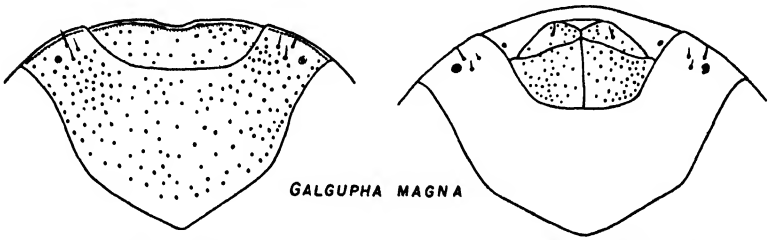
*Contribution from the Department of Entomology, University of Kansas.

straight to convex, posterior and inner margins subequal. Length 5—6.1 mm.

Comparative notes: Belongs to the **nitiduloides** complex. It is difficult to assign the exact relationship of this species within this group, because of the lack of material representing several of the species of the group; however, it is probably most closely allied to **nitiduloides texensis** McA. and M. G. **magna** sp n. appears to be the largest, least punctate, most polished of the complex.

Recorded locality and additional data: Cuernavaca, Morelos, Mexico; July 3, 1938; L. J. Lipovsky, collector.

Types: holotype, male; allotype, female; paratypes, one female in the Francis Huntington Snow collection of the University of Kansas; one paratype female in the U. S. National Museum collection.



Sixth sternite and hypopygium *Sixth sternite and genital plates*

Key to species of **nitiduloides** complex as modified by addition of **G. magna.**

1a. Metalic blue or bluish forms ______________**caerulescens** (Stal).
1b. Castaneous to black form ______________________________2a.
2a. Genital plates on inner margins not longer, sometimes distinctly shorter than fifth sternite at center ____________3a.
2b. Genital plate on inner margins distinctly longer than fifth sternite at center ________________________________3b.
3a. Less numerously punctate; postero-medial part of vertex, disc of pronotum and anterior disc of scutellum, indistinctly, if at all punctate; punctures rastrate, if at all, only in transverse impression of pronotum; hind margin of hypopygium shallowly concave medially _________________________ **nitiduloides texensis** McA. & M.
3b. More numerously punctate, areas mentioned with punctures more distinct often well-marked and tending toward rastrate particularly on posterior half of pronotum; hind margin of hypopygium varying from slightly concave to convex__**nitiduloides nitiduloides** (Wolff).
4a. Scutellum dull, crowded, punctate, more or less rugose and rastrate peripherally _______________**bakeri** McA. & M.
4b. Scutellum polished, only moderately punctate ______________5a
5a. Length less than 4 mm. ______________________**eas** McA. & M.
5b. Length 4.75 mm. and larger __________________**magna** sp n.

NEW WESTERN DOLICHOPODIDAE (DIPTERA)[1]

F. C HARMSTON and G. F. KNOWLTON[2]

The following descriptions include two apparently undescribed **Dolichopus** and one **Medeterus.** The previously undescribed male of **Polymedon nigrifemoratus** Van D. also is described[3].

Dolichopus beameri n. sp.

Male: Length, 3.9 mm.; of wing 3.5 mm. Face rather wide, silvery pollinose. Front metallic green, more bronze in the middle, without any indication of pollen. Antennae wholly black, third joint slightly longer than wide, bluntly pointed. Inferior orbital cilia white, the upper black cilia descend a little more than one-third the eye height. Palpi brownish.

Dorsum of thorax metallic green, with bronze reflections; pleurae concolorous with dorsum, dulled with white pollen. Abdomen metallic bronze, the dorsum of first three segments more greenish; hypopygium black, somewhat dulled with gray pollen, its lamellae (fig. 6) moderately large, somewhat quadrilateral in outline, whitish with narrow black apical and upper margin, somewhat jagged and bristly at apex.

Coxae black, the fore pair yellowish at tip and broadly so on inner apical portions, the anterior surface clothed with short black hairs and the usual black bristles at tip; mid and hind coxae narrowly yellowish at tip. Fore femora black on outer surface, the apical third and inner surfaces yellowish brown; middle and hind femora yellow, the latter broadly blackened above at tip (in some specimens appearing narrowly blackened on entire upper edge); middle and hind femora each with a single preapical bristle, the latter ciliated on apical half of lower inner surface with pale cilia which are nearly as long as the width of femora; tibiae yellow, the posterior pair blackened, and noticeably thickened, on apical third. Fore and middle tarsi black from tips of first joint, the joints of the fore pair (fig. 4) narrowed at base, middle basitarsi each without a bristle on upper surfaces; posterior tarsi wholly black, their basitarsi noticeably thickened, appearing slightly inflated. Joints of fore tarsi as 12-5-4-3-3; of middle tarsi as 15-7-6-4-4; of hind tarsi as 16-11-7-5-4. Calypters and halteres yellow, the former with black cilia.

Wings grayish hyaline; costa with a conspicuous knot-like enlargement at the tip of first vein; last section of fourth vein bent near

[1]Contribution from the Department of Entomology, Utah Agricultural Experiment Station Project 51-A.

[2]Graduate research assistant and research associate professor, respectively.

[3]The material upon which this study is based was lent by the University of Kansas through the kindness of Dr. R. H. Beamer.

its basal third, ending considerably before the wing apex. Anal angle evenly rounded, moderately prominent.

Female: Like the male in general external appearance. Differs in face being much wider, the costa without a knot-like swelling at the tip of first vein; the posterior basitarsi are not noticeably enlarged.

Described from four males and 1 female, all taken in the Chiricahua Mountains, Arizona, July 8, 1932 by R. H. Beamer. Holotype, allotype and one paratype male returned to the Department of Entomology, University of Kansas; two paratype males retained in the insect collection of Utah Agricultural Experiment Station. This species is named in honor of Dr. R. H. Beamer of the University of Kansas, in appreciation for the large number of specimens from the excellent Snow Insect Collection which he has lent the authors.

Taxonomy: **Dolichopus beameri** n. sp. is much like **D. nigrilineatus** V. D., from which it may be easily distinguished by the knot-like swelling of costa and the presence of long pale cilia on inner apical half of lower edge of posterior femora; the above structures being absent in **nigrilineatus.** From **D. bryanti** V. D., to which it traces in the Van Duzee and Curran key (Amer. Mus. Novit. No. 683), it is distiguished by the form of the hypopygial lamellae, which in **bryanti** are somewhat triangular, with fine black spots upon the outer surface near the base, each spot giving rise to a fine hair; the lamellae in **beameri** n. sp. are quadrilateral and are wholly pale-yellow except for the black apical margin. The posterior tibiae are black except narrowly yellow at base in **bryanti,** instead of yellow with apical one-third black as in **beameri** n. sp.

Dolichopus accidentalis n. sp.

Male: Length, 4 mm.; of wing 4 mm. Face moderately wide, greyish pollinose, yet appearing slightly yellowish in certain lights. Front metallic green, more bluish in the middle. Antennae wholly black, the third joint slightly longer than wide, conical in outline, rounded at tip. Orbital cilia white, with about 6 upper cilia on each side black. Palpi blackish, the lower portion shading to a yellowish color.

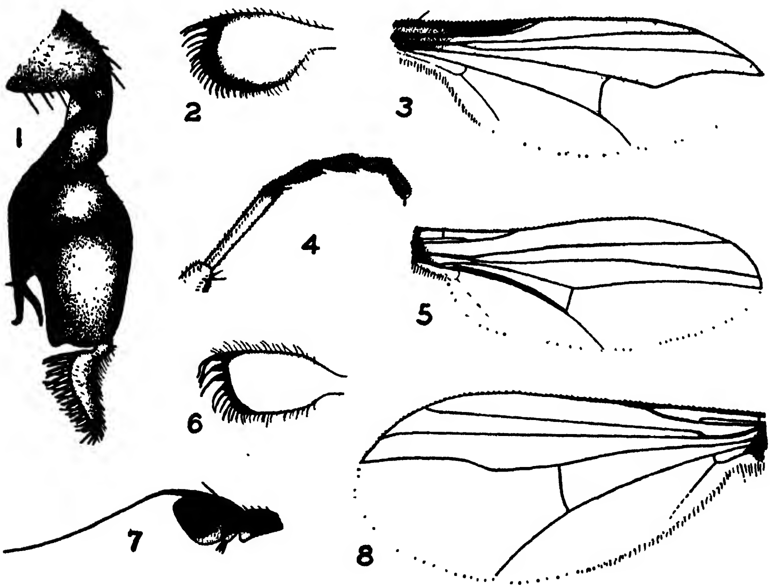
Dorsum of thorax and abdomen metallic, dark green with bronze reflections; scutellum with a few delicate pale hairs on the margin between the single pair of macrochaetae; pleurae densely dusted with greyish pollen, the greenish ground color more noticeable on upper portions. Hypopygium black, its surface slightly dulled with greyish pollen, the lamellae (fig. 2) nearly orbicular, yet jagged at apex, yellowish-white with broad black apical margin.

Coxae black, whitish pollinose, the fore and middle pairs with

black hairs upon their anterior surface, in addition to the usual black bristles at tip. Femora and tibiae yellow, the tips of posterior femora conspicuously black on upper edge, the posterior tibiae slightly thickened and black on about apical fifth; middle and hind femora each with a single preapical bristle, the latter ciliate on lower inner edge with a row of hairs of increasing length that begin near the basal third of femora and continue to the apical fourth, the shorter basal bristles more yellowish and delicate, those near apex of femora black and nearly three-fourths as long as the width of femora at its widest point; middle tibiae without a bristle below. Fore and middle tarsi yellow, blackened from the tip of first joint; fore pair with fourth and fifth joints noticeably flattened dorso-ventrally, their edges fringed with very short black bristles; middle basitarsi without a bristle on upper surface; posterior tarsi wholly black. Joints of fore tarsi as 14-8-5-4-5; of middle tarsi as 20-10-9-6-5; of hind tarsi as 20-15-10-8-5. Calypters and halteres pale yellow, the former with black cilia.

Wings (fig. 8) greyish hyaline; costa with an elongate thickened area at tip of first vein which tapers gradually toward wing tip; fourth vein broadly bent before its middle, ending considerably before wing tip; anal angle evenly rounded, not at all prominent.

Described from one male taken at Spring Creek Pass, Colorado, June 29, 1937, by C. L. Johnson. Type returned to the Department of Entomology, University of Kansas.



Taxonomy: **Dolichopus accidentalis** n. sp. traces to **nigricoxa** V. D., couplet 159, of the Van Duzee and Curran Key (Amer. Mus. Novit. No. 683) if one considered the fore tarsi to be compressed; if the fore tarsi were considered to be plain it would trace to **sincerus** Melander, couplet 171. **Dolichopus accidentalis** may readily be distinguished by having a strong preapical bristle on the posterior femora; this is absent in the **nigricoxa**; the fifth joint of fore tarsi is greatly compressed and widened, almost triangular and twice as long as the fourth segment in **nigricoxa**, whereas in **accidentalis** the fourth and fifth segments of fore tarsi are but slightly flattened and the fifth joint is barely longer than the fourth. From **sincerus**, which it resembles in general appearance; **accidentalis** differs in having cilia on the lower inner edge of posterior femora, while the hind femora of **sincerus** have, at most, a row of delicate yellowish cilia on lower edge; the fore tarsi are of plain structure in **sincerus**, are not perceptibly flattened dorso-ventrally as in **accidentalis**.

Medeterus alpinus n. sp.

Male: Length, 1.7 mm.; of wing, 1.5 mm. Face rather wide, greenish, scarcely dulled with grey pollen. Front concolorous with face yet its pollen more dense. Antennae black; third joint nearly orbicular, but slightly larger than the first or second joint; all joints and the apical arista pubescent. Orbital cilia wholly white. Proboscis black with delicate white cilia. Palpi brownish.

Thorax, including the pleurae, greenish, quite thickly dusted with grey pollen; dorsum on its anterior portion with bluish reflections; bristles of thorax wholly yellow, the scutellum with a single large pair of marginal bristles, outside of which is a pair of small hair-like bristles; acrostichal bristles small, biseriate. Abdomen dark metallic green, lightly dusted with greyish pollen, the last two segments, especially on dorsum more blackish; hairs of abdomen wholly yellow. Hypopygium and its appendages black, the former comparatively large, bent forward beneath the abdomen, rather broadly truncate at apex.

Coxae black, the anterior surface of fore and middle pairs with pale hairs and bristles; posterior coxae with a single yellowish bristle on outer surface. Femora, tibiae and tarsi yellow, the basal half of all femora, and the apical joint of all tarsi perceptably infuscated; hairs of legs delicate, pale; posterior tibiae with a sharp, slightly-curved bristle on outer edge at extreme tip, this bristle being about as long as the width of tibiae. Joints of fore tarsi as 5-3-2-2-2; of middle tarsi as 9-5-3-2-2; of hind tarsi as 6-9-5-3-3; apical joint of middle and hind tarsi considerably flattened when viewed from the side. Calypters and halteres pale yellow, the former with pale cilia.

Wings (fig. 5) grayish hyaline, the veins, with exception of the fifth vein, yellowish; fifth vein broadly flattened and black as far as posterior cross-vein, the latter about one-half the length of last portion of fifth vein; anal angle evenly rounded, prominent.

Described from one male, taken at Alpine, California, July 9, 1929, by R. H. Beamer. Type returned to the Department of Entomology, University of Kansas.

Taxonomy: Medeterus alpinus n. sp. traces to **M. longinquus** V. D., couplet 11, in the Van Duzee key (Phyche, 35: 39. 1928) differing from that species, however, in possessing yellow thoracic bristles; the thoracic bristles of **longinquus** are black. The only other Nearctic species of **Medeterus** having a greatly broadened fifth vein, **crassivenis** Curran, has black femora and tibiae and is thus easily distinguished from **alpinus** n. sp. in which these are yellow.

Polymedon nigrifemoratus Van D.

Male: Length, 5.5 mm.; of wing, 5 mm. Face silvery white, wide, its sides nearly parallel, yet slightly narrowed in the middle, extending below the lower corner of eyes a distance about equal to its width at narrowest point; front blackish, not shining, lightly dusted with grey pollen. Antennae (fig. 7) black, the first joint at tip below, the second and third joints on lower one-third yellowish; arista long, tapering, scarcely pubescent. Orbital cilia white, with the five upper cilia on each side and a strong bristle near the proboscis black.

Dorsum of thorax metallic green, with bronze reflections, dulled with greyish pollen, the pollen more conspicuous on lateral edges and before scutellum; scutellum with a single pair of large bristles, outside of which is a single pair of small, cilia-like hairs; acrostichals small, biseriate; dorsum of thorax on its anterior portion thickly covered with dense, short, hair-like bristles; pleurae more blackish than the dorsum, its surface densely greyish pollinose. Abdomen shining green on dorsum, the posterior margin of each segment narrowly black; venter and lateral abdominal margins densely greyish pollinose. Hypopygium (fig. 1) black, greyish pollinose; outer lamellae elongate-triangular, blackish yet more brown toward the stems; outer and lateral margins of lamellae ciliated with fine yellow-brown cilia, the cilia of inner surface black, stiff and dense.

Coxae concolorous with pleurae, the extreme tips of all pairs narrowly yellow; hairs and bristles of all coxae black. Femora black, with dense greyish pollen, all with yellow tips; middle femora with a single preapical bristle; posterior femora with a row of four large bristles ending in the usual preapical bristle. Tibiae yellow; fore

pair slightly thickened and brownish at extreme tip, possessing two slender brownish bristles at the tips, the latter extending alongside the fore basitarsus; middle tibiae without a bristle below, but with the postero-dorsal and antero-dorsal bristles strikingly prominent; fore femora of plain structure, their chaetotaxy similar to middle pair. Tarsi blackened from the tip of first joint, yet the basal portion of the second joint of middle tarsi mostly brownish; fore tarsi with first joint slightly thickened at tip, the remaining joints short, compact and somewhat enlarged, the pulvilli enlarged, prominent; middle tarsi conspicuously bowed outward between the second and third joints (as is characteristic of many males of the genus) the second joint when viewed from below somewhat widened at tip, glabrous on apical half, third joint glabrous on entire ventral surface; posterior basitarsus with a single prominent bristle on antero-ventral surface near extreme base, the remaining joints plain. Joints of fore tarsi as 18-4-3-3-4; of middle tarsi as 25-11-9-5-5; of hind tarsi as 20-23-14-8-6. Calypters yellow, of peculiar structure, the usual row of cilia situated below a greatly expanded, somewhat globose area, the latter brownish at tip, from which arises a tuft of long cilia that are pale at base, becoming almost black at tip. In some males examined the cilia are agglutinated, forming a long spur-like structure; in others the cilia are separated, forming a beautiful, golden tassel. As Aldrich pointed out (Biol. Cent.-Amer., 1: 335) it is highly probable that the cilia may be opened or closed, resulting in a strikingly beautiful secondary sexual character; halteres pale yellow.

Wings (fig. 3) greyish, with a brownish tinge in front and along the posterior cross-vein; costa greatly thickened, black, entirely filling the space between the first vein and costa; fourth vein with a broad bend before the middle of last portion; cross vein noticeably concave on its posterior side; anal angle evenly rounded, quite prominent.

The single female specimen from which this species was originally described by Van Duzee (Ann. Ent. Soc. Amer., 20: 125. 1927), is well described and there is no need for further description.

Description of male from neallotype male and seven parallotype males, all from Santa Rita Mountains, Arizona, July 7-24, 1927, collected by L. D. Anderson. A series of 21 females, all with the same collection data, also was examined. Neallotype male. four parallotype males and 16 females returned to the Department of Entomology of University of Kansas.

LEGEND

Dolichopus beameri n. sp. Male, 6, 4. **D. accidentalis** n sp. Male, 2, 8. **Medeterus alpinus** n sp. Male, 5. **Polymedon nigrifemoratus** Van D., Male, 1, 3, 7

A NEW SPECIES OF THE EURYTOMA RHOIS COMPLEX FROM THE SEEDS OF SCHMALTZIA (RHUS) TRILOBATA. (EURYTOMIDAE)

ROBERT E. BUGBEE, Fort Hays Kansas State College

The new species described below is temporarily placed in the rhois complex. In some respects it differs enough from typical rhois to warrant a separate complex standing. At present, however, as only two species of the rhois complex are known, it seems better to place all three together until more is known about the seed feeders confined to sumac seeds.

Eurytoma seminis, n. sp.
rhois complex
Fig. I and Plate I, Figs. 2-6.

Female—Length 2.7 to 3.5 mm.; average 3.2 mm. Largest known species of the rhois complex. Abdomen globular from a lateral view; a few (3-7) silvery white hairs on segment six, dorso-laterally; maybe also a few very short white hairs on segments 7, 8, and 9 which are longer and more numerous than in E. **rhois**; 9th abdominal segment short and stubby but averages .18 mm. in length; this is longer than in E. **rhois** which averages about .11 mm. in length; the width of the 6th abdominal segment is about 1.2 times the width of the 5th; the internal genitalia average about 1.5 mm. in length; the dorsal extension of the ventral and dorsal valves is very slight; the amount of black color on the dorsal valves and along the upper edge of the dorsal extension of the ventral valves is more extensive than in **E. rhois.** Legs—Coxae are black; trochanters deep reddish-brown; hind-femur with considerable black medially and with deep reddish-brown on outer tip; mid-femur may show a slight blackish tinge basilly but most often it is all reddish-brown; fore-femur with black basilly flaring upwards to cover from 1/3 to 3/4 of surface, rest reddish-brown; hind, mid and fore-tibia show no black but are reddish-brown being deepest medially and becoming lighter toward tips. Antenna averaging 1.02 mm. in length; filiform and with the individual segments cylindrical; scape all reddish-brown. Wings with the veins lemon yellow; postmarginal and marginal veins most often subequal in length; occasionally postmarginal shorter than the marginal; postmarginal averages .22 mm. and the marginal .25 mm. in length; stigmal club elongate and gently rounded basilly.

Males—Length ranges from 2.5 to 3.2 mm. with an average of 2.9 mm.; scape black except for slight deep reddish-brown tinge at extreme base in a few. 6th abdominal segment averages about 1½ times the width of the 5th abdominal segment.

Larvae—average in length from 3.0 to 3.5 mm. with an average

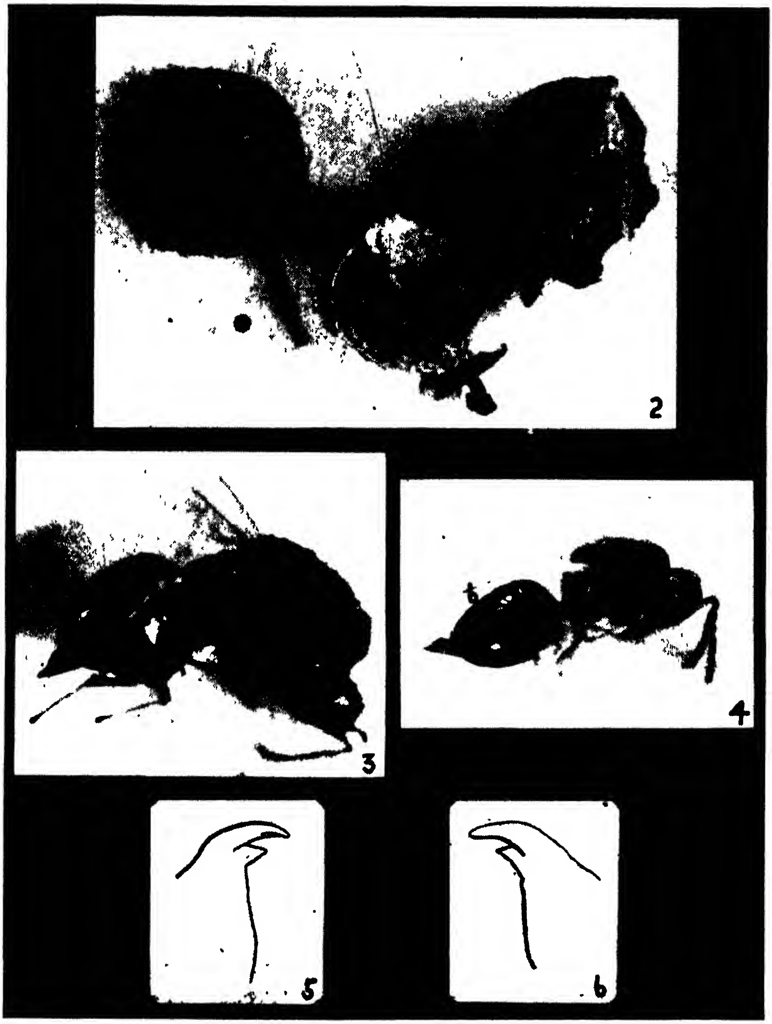


PLATE I

Figure 2. Seeds of **Schmaltzia trilobata** showing emergence holes. Seeds enlarged about 8 X.

Figure 3. Female of **Eurytoma seminis** n. sp. Enlarged 30 X. Note width of 5th and 6th abdominal segments.

Figure 4. Female of **E. rhois** Crosby. Enlarged 30 X. Note width of 5th and 6th abdominal segments.

Figures 5 and 6. Mandibles of larva of **E. seminis.** Enlarged 330 X.

of 3.2 mm. Mandibles bidentate; the upper tooth longer than the underlying second tooth. Plate I, Figs. 5 and 6.

Types—15 females and 8 males. Holotype female and paratypes of both sexes in the Bugbee collection. Paratype females and males in the U. S. National Museum.

Type locality—Hays, Kansas, 3 miles west (college pasture).

Additional localities—Woodward, Oklahoma and 15 miles north of Hays, Kansas.

Host—Schmaltzia (Rhus) trilobata, (Nutt, 1838) Barkley, 1940.

Range.—According to Barkley (1937 and 1940), **Schmaltzia (Rhus) trilobata** ranges westward from the Mississippi river to the eastern slopes of the Sierra Nevada; northward to the southern front of Alberta and southward into Mexico to the state of Puebla The phytophagous seed wasp so far is recorded only from Kansas and Oklahoma but may be expected to cover most if not all of the range of its host. (See Map. Fig. 1).

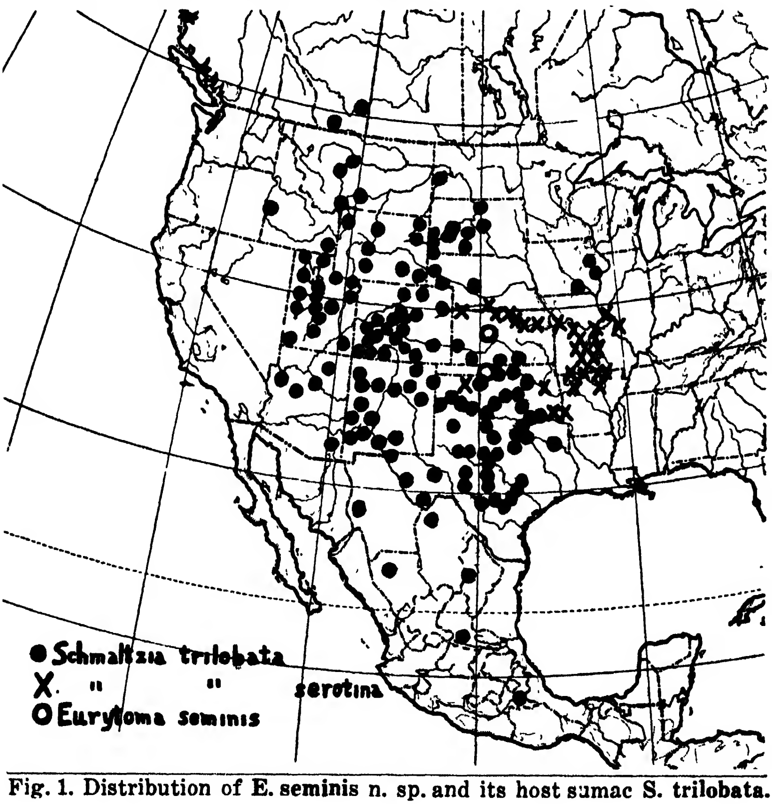


Fig. 1. Distribution of E. seminis n. sp. and its host sumac S. trilobata.

Only three species are known in the rhois complex (i. e. **Eurytoma rhois** Crosby (1909), **E. compressa** Bugbee (1939) and the one described above). **E. seminis** can be distinguished very easily from both of the other species by its much larger size, differently shaped abdomen, narrow 6th abdominal segment in relation to segment 5 in both the male and female, (plate I, Figs. 3 and 4), lack of any black on the tibia and the different host.

Notes on the Biology of E. seminis

The adults emerge from the seeds beginning in early May (actual earliest date is May 5, 1941) and continue to the last of May or early June (latest date, June 2, 1940). They leave small round holes as evidence of emergence (Plate I, Fig. 2). If the seeds are cut open during the winter the fat larvae are found to have eaten the heart out of the seeds, leaving a hollow center in which they repose. At this time of the year they are inactive and apparently not feeding. The percentage of infestation of seeds varies considerably. At one locality (Hays, Kansas) 15 of 35 seeds examined were infested, or approximately 43%. Material from another locality (Hays, Kansas, 15 miles north) yielded only 5 larvae out of 25 seeds or 20%. W. R. Van Dersal (1939) states that **S. trilobata** is a hardy shrub and should be encouraged especially where erosion control is needed. It withstands drouth conditions well. If the seeds are used to establish it, a large number should be used in order to assure results as those infested by the larvae of **E. Seminis** will be sterile. It is further of value as forage for some 19 species of birds including the prairie chicken, gambel and western quail, bobwhite and ring-neck pheasant, as well as the mule deer.

Attempts have been made to rear the larvae through to the adult in the laboratory. This was easily done with numbers of the larvae of **E. rhois** (Bugbee, 1939) but so far it has been impossible to force the larvae of **E. seminis.** The significance of this is not clear but it does emphasize a physiologic difference between the two species. On the other hand a parasite of the **Eurytoma** larvae has been forced. This species belongs to the genus **Idiomacromerus** of the family **Callimomidae** and according to Gahan, of the U. S. National Museum, seems to be identical with the genotype species **Idiomacromerus bimaculipennis** Crawford. Crawford's species was described from one specimen collected in American Fork Canyon, Utah. The number of the parasites appears to be relatively small and thus of no great consequence as a natural control measure.

LITERATURE CITED

Barkely, F. A. 1937. A monographic study of Rhus and its immediate allies in North and Central America, including the West Indies. Anns. Missouri Bot. Garden 24: 263-498.

Barkely, F. A. 1940. **Schmaltzia.**
Amer. Midland Nat., 24(3): 647-665.

Bugbee, R. E. 1939. A discussion of the **Eurytoma rhois** complex with a description of a new species (Eurytomidae).
Anns. Ent. Soc. Amer., 32(2): 415-427.

Crosby, C. R. 1909. On certain seed-infesting chalces-flies.
Cornell U. Agric. Exp. Sta., Dept. Ent., Bull. 265: 367-388.

Van Dersal, W. R. 1939. Native woody plants of the United States.
U. S. Dept. Agric., Miscellaneous Pub. No. 303: 1-362.

A REVISION OF TWO GENERA OF NORTH AMERICAN CERCOPIDAE (HOMOPTERA)

KATHLEEN C. DOERING, Lawrence, Kansas*

ABSTRACT

A complete revision of the genus **Aphrophora** for North America has been attempted. Two new species, **maculosa** and **fulva** are described, making a total of fifteen species for the genus. This does not include **corticea** (Germar), a European species which Ashmead (1904) reported taken in Alaska by the Harriman Expedition since no specimens have been found in any of the collections thus far studied. Three of Walker's species are still considered to be synonyms. These are: **Aphrophora fascialis** as **Aphrophora quadrinotata** Say, **Ptyelus cribatus** as **parallela** (Say), and **Ptyelus gelidus** as **saratogensis** (Fitch). **Detritus** Walker, described from Florida, is considered as a distinct species from **saratogensis** (Fitch), based on distribution, host records, and structure. The validity of Walley's species **canadensis**, **punctipes**, and **princeps**, which Ball (1934) opposed has been confirmed through the study of longer series of specimens and more careful comparisons. Separate keys to males and females have been made in an attempt to use characters which will assist workers in classifying with greater accuracy female specimens when no male specimens occur along with them to verify them by the distinctive male plates. Drawings of the head and pronota of the females and genital plates and last sterna of the males are included.

Comparative notes concerning **Clastoptera globosa** Fowler are given and the key to the species and varieties in this genus has been revised to include this species, which recently has been collected at Brownsville, Texas.

*Contribution from the Department of Entomology, University of Kansas.

BIBLIOGRAPHY

Ashley, K. The Froghopper or Cuckoo-Spit, Gardner's Chronicle, London LXV, no 1681, Mar. 15, p. 122, 1919.

Ashmead, Wm. H. Harriman Alaska Exp. VIII, p. 31, 1904.

Ball, E D A Review of the Cercopidae of North America North of Mexico. Report of Iowa Acad of Sci for 1898: 204-226, 1898.

——— The Food Habits of Some Aphrophora Larvae. Ohio Naturalist I: 122-124, 1901.

——— Adaptations to Arid Conditions in Cercopidae and Membracidae. Annals of Entomological Society of America VIII: 365-368, 1915.

——— Notes on the Cercopidae of America North of Mexico. Entomological News, Vol. XXXIX 47-49, 1928.

——— The Spittle Insects of the Genus Aphrophora Occurring in the U. S (Homoptera, Cercopidae). Entomological News, Vol XLV 175-179, 1934

Barber, H J Insects of Florida (Hemiptera, Cercopidae) Bull. Amer. Mus. of Nat. History XXXIII 495-535 1914

Burmeister, Herman Handbuch der Entomologie II, p 123, 1835.

Fitch, Asa Homoptera N York State Cabinet p. 53 1851

——— Insects Effecting the Grape Transactions of the New York State Agric Soc. 16 389. 1856.

Glover, Townsend Report of U S Department of Agriculture 31, 1876.

——— Report of the Entomologist and Curator of the Museum—Homoptera pp 17-46. 1877.

——— Manuscript Notes from my Journal or Entomological Index to names, etc. in Agricultural Reports for 1876-77.

Gillette, C P and Baker, Carl F A Preliminary List of the Hemiptera Colo. Bull. Agric. Exp Sta 31. Technical Series I: 70-71 1895.

Goding, F W Synopsis of the Subfamilies and Genera of the North American Cercopidae with a Bibliographical and Synonymical Catalogue of the Described Species of North America Bull Ill State Lab of Nat. History III 483-501, 1895

Harris, T. W. A Treatise on Some of the Insects Injurious to Vegetation, Edn 3, p. 225 1862.

Lintner, J. A. Fourth Report of N. York State Entomologist, p. 242. 1889.

McAtee, W. L. Cercopidae of the Vicinity of Washington, D C., with Descriptions of New Varieties of Clastoptera (Homoptera). Proceedings of the Biological Society of Washington 33: 171-176. 1919.

Melichar, L. Cicadinan - Hemiptera - Homoptera von Mittel-Europe 113-21, 1896.

Metcalf, Z. P A List of Homoptera of North Carolina Jr. of Elisha Mitchell Sci. Soc. XXXI, No. I, 1915.

——— and Barber, G. W. Notes on **Aphrophora salicis** in America. Psyche, A Journal of Entomology 36: 51-56.

Osborn, Herbert. Homoptera of Florida. The Florida Entomologist V: 2-19, 1921.

Packard, A. S. Guide to the Study of Insects, p. 532. 1878.

Provancher, Leon. Petite Faune Entomologique du Canada III: 253-260, 1885-1900.

Saunders, William. Fruit insects, pp. 242, 127. 1883.

Say, Thomas. Long's Second Expedition II, p. 303, 1924. Compl. Writings 1: 202.

——— Jr. Acad. Nat. Sci. Phila. VI; 304, 1831. Compl. Writings 381.

Smith, John B. Catalog Insects of New Jersey: 443, 1890.

——— Report N. J. State Museum for 1909, 1910.

Snow, F. H. List of Hemiptera taken in Ariz. 1902-1903. 1904.

Surface, H. A. Study of Insects, Homoptera. Zoological Bulletin of the Division of Zoology of the Penn. Dept. of Agric. Vol. 5, No. 3: 69-86.

Stearns, Louis Agassiz. Guide to Insects of Connecticut—Family Cercopidae. State Geol. and Nat Hist. Survey, Bull. 34. 206-238, 1923.

Uhler, P. R. List of Hemiptera of the Region West of the Mississippi River, including those Collected during the Hayden Explorations of 1873. Bulletin U. S. Geol Geog. Survey II: 270-361, 1875.

——— On the Collections of Insects Made by Dr. Elliott Coves, U. S. A in Dakota and Montana during 1873 and 1874, Bulletin of Geology and Geographical Survey IV, No. 2 481-517. 1878.

——— Riverside Natural Hisroty II: 242-244. 1884

Van Duzee, E. P. Hemiptera of Muskoka Lake District of Canada Canadian Entomologist XXI: 8, 1889.

——— Synonymy of the Homoptera Described by Say, Harris and Fitch. Psyche V: 388, 1890.

——— A List of Hemiptera of Buffalo and Vicinity. Bull. Buff. Soc. of Nat. Sci. V: 193, 1894.

——— Insects Taken at Beulah, New Mexico. Transactions American Ento. Society XXXIX: 111, 1903

——— List of the Hemiptera Taken in Adirondack Mountains, 20th Report of N. York State Entomologist for 1904, 1905

——— Notes on Hemiptera Taken by W. J. Palmer, near Lake Temagami, Ontario. Canadian Entomologist XXXVIII, 409, 1906.

——— List of Hemiptera Taken by W. J. Palmer, About Cumze Lake, Province of Quebec in 1907. Canadian Entomologist XL: 115, 1908.

——— Observations on Some Hemiptera Taken in Florida in the Spring in 1908, Bull. Buffalo Society Nat. Sci. IX: 204, 1909.

——— Synonymy of the Provancher Collection of Hemiptera. Can. Ent. XLIV: 327, 1912.

———A Preliminary List of the Hemiptera of San Diego Co., California. Transactions San Diego Society of Natural History II: 48, 1914.

Walker, Francis. List of Homoptera III: 697, 1851.

——— Insects Saundersiana (Homoptera), pp. 1-117, 1858.

Walley, G. S. The Genus Aphrophora in America North of Mexico. Canadian Entomologist 60: 184-192. 1928.

Wirtner. Annals of the Carnegie Museum III: 216, 1904.

APHROPHORA

Key to Female Specimens

1. Median length of head greater than one-third of greatest width of head; frons greatly protruding so that postclypeus is conspicuously visible from above ---------------------------------- **parallela** (Say) (northeastern)

   Median length of head not over one-third of greatest width or only slightly so; postclypeus not conspicuously visible from above ------------------------ 2

2(1). Width of head greater than width of pronotum; lateral margins of pronotum parallel; base of costa and two distinct spots on costal margin white-- ------------------------------------- **quadrinotata** Say (east of Rockies)

   Pronotum as wide as head or slightly wider; lateral margins of pronotum diverging posteriorly; no distinct white spots except in **annulata** ---------------- 3

3(2). Lateral margin of vertex between eye and frons equal to median length of head ------------------------ 4

   Lateral margin of vertex longer ------------------------ 6

4(3). Tegmina broad, costa ampliate, two large light spots along costal region ------------------------ **angulata** Ball (Cal. and Wash.)

   Tegmina slender, more nearly parallel-sided; no distinct light colored costal areas ------------------------ 5

5(4). Head somewhat conically produced, the median length one-third its width ---------------- **salicis** DeGeer (introduced)

   Head roundingly produced, its median length less than one-third its width ---------------- **signoreti** Fitch (north central—restricted)

6(3). Median length of head less than one-third median length of pronotum ------------------- **punctipes** Walley (Cal. and Wash.)

   Median length of head over one-third median length of pronotum -- 7

7(6). Median length of vertex distinctly longer than lateral margin of pronotum; median length of head approximately one-half median length of pronotum; usually a broad, irregular cream stripe across head and anterior part of pronotum------**saratogensis** (Fitch) (northeastern)

Median length of vertex not longer or only slightly longer than lateral margin of pronotum; median length of head considerably less than one-half length of pronotum (expect **canadensis**); cream stripe not more than a line 8

8(7). Median length of head much over one-fourth the total width of head .... **annulata** Ball (western mountains; rare)

Median length of head either one-fourth or only slightly over and under one-fourth of total width........ 9

9(8). Median length of head one-half median length of pronotum .... **canadensis** Walley (Cal. and Brit Col.)

Median length of head less than one-half median length of pronotum 10

10(9). Median length of head one-fourth of width of head or over 11

Median length of head less than one-fourth width of head 13

11(10). Median length of frons longer than median length of vertex .... **irrorata** Ball (Southwestern and western)

Median length of frons equal to or less than median length of vertex 12

12(11). Ocelli small; distance from ocelli to posterior margin of vertex twice diameter of ocelli .... **detritus** Walker (Southeastern)

Ocelli large; distance from ocelli to posterior margin of vertex equal to diameter of ocelli .**permutata** Uhler (western; common)

13(10). Dark, uniformly punctured with dark ......**princeps** Walley (Cal. and extreme northwest)

Tawny-colored, inconspicuously mottled with light 14

14(13). Median length of head one-fourth combined length of head and thorax; peak of carina on vertex in line with anterior margin of ocelli ....**maculosa** n. sp. (California)

Median length of head over one-fourth combined length of head and thorax; peak of carina halfway on vertex or anterior to ocelli ....**fulva** n. sp. (Cal.)

Key to Males

1. Combined genital plates with a deep, rectangular median notch, united only through basal fourth, each plate shallowly arcuate ---------- **quadrinotata** Say
Combined genital plates not notched, or if so notch is triangular, united through more than basal fourth, plates not longitudinally arcuate ---------- 2

2(1). At least distal third of plates considerably narrowed, ending as arm-like projections ---------- 3
Distal third not forming a narrowed projection; either truncate or roundingly pointed at apex ---------- 7

3(2). Each plate not more than one-third longer than its basal width ---------- 4
Each plate at least more than one-half longer than its basal width ---------- 5

4(3). Each plate at base equal to length, with a broad, truncate, darkly colored apex ---------- **annulata** Ball
Each plate about one-third longer than its basal width and its apex more pointed ---------- **signoreti** Fitch

5(3). Median length of 9th sternum considerably over twice median length of 8th sternum; genital plate more slender, constricted just before apex to one-half width at middle; deep brown colored insects ---------- **permutata** Uhler
Median length of ninth sternum twice length of eighth sternum; genital plate expanded through middle, constricted at apex to less than one-half median width ---------- 6

6(5). Length of genital plate equal to median length of ninth sternum; combined width of genital plates at apex less than width of one plate through middle ---------- **maculosa** n. sp.
Length of genital plate about one-third longer than ninth sternum; combined width of genital plates at apex equal to width of middle ---------- **fulva** n. sp.

7(2). Each genital plate truncate, posterior margin shallowly concave ---------- 8
Genital plate with pointed apex ---------- 10

8(7). Genital plates united at middle for a distance less than one-half their length; mesal angle of each plate sharply projecting, somewhat depressed so that it is not on same plane as rest of plate from ventral view ---------- **irrorata** Ball

Genital plates, united at middle for three-fourths their length; mesal angle not conspicuously projected; not depressed, or only slightly so ---------------9

9(8). Basal width of one plate less than greatest length, mesal angle reflexed, notch between plates wider than width of plate -------------------**princeps** Walley

Basal width of one plate greater than length, mesal angle not reflexed; notch inconspicuous ----**angulata** Ball

10(7). Greatest length of genital plate at outer margin, length of plate and ninth sternum about equal; median length of vertex slightly longer than meian length of frons ------------------------------------11

Greatest length of genital plate in middle or mesad of middle; length of plate either much longer or much less than length of ninth sternum; median length of vertex equal or less than length of frons------12

11(10). Length of plate about one-sixth greater than width; ninth sternum one-half of eighth; median length of vertex longer than lateral margin of pronotum ------------------------------------**saratogensis** (Fitch)

Width of plate subequal to length; ninth sternum two-thirds of eighth sternum; median length of vertex equal to lateral margin of pronotum------ ---------------------------------------**detritus** Walker

12(10). Ninth sternum much longer than length of genital plate --13

Ninth sternum much shorter than length of genital plate --14

13(12). Median length of ninth sternum not quite twice median length of eighth sternum; median length of frons much longer than median length of vertex; postclypeus greatly inflated -------------**parallala** (Say)

Median length of ninth sternum more than twice median length of eighth sternum; median length of frons and vertex equal; postclypeus not inflated --------------------------------------**canadensis** Walley

14(13). Ninth sternum less than one-half length of eighth; genital plates more than twice length of ninth sternum; frons longer than median length of vertex -----------------------------**punctipes** Walley

Ninth sternum two-thirds as long as eighth sternum; genital plates approximately one-third longer than ninth sternum; frons and vertex equal ----**salicis** DeGeer

(To be concluded in the October issue)

REPRINT PRICES

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

Pages	1-2	3-4	5-8	9-12	13-16	17-20	21-24	25-28
50 copies	$1.10	$1.40	$3.85	$5.25	$7.45	$ 9.65	$11.85	$14.05
100 copies	1.40	1.65	4.15	5.30	8.00	10.20	12.40	14.60
200 copies	1.65	2.20	4.95	7.15	9.35	11.55	13.75	15.95
100 Add'n'l	0.55	1.10	2.20	3.30	4.40	5.50	6.60	7.70

Tables—for setting up—$1.25 per page extra.

Covers, per 100—$2.50

Fifty copies of reprints are free to the authors provided at least 50 copies are purchased. Reprints should be ordered in lots of 50 or multiples thereof.

Postage or express charges on carriage of reprints are extra.

PRICE OF BACK VOLUMES

Volume 1 .... $2.00
Volumes 2 to 7 inclusive 1.00
Volumes 8 to date 1.50

Subscriptions for back volumes or numbers should be sent to the Secretary-Treasurer, Entomology Department, Kansas State College, Manhattan, Kansas.

CONTENTS OF THIS NUMBER

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

A quarterly journal published in January, April, July and October devoted to Entomology in the Western Mississippi Basin and the proceedings of the Kansas Entomological Society.

Manuscripts for publication may be sent to any of the publication committee.

The Kansas Entomological Society does not make exchanges since the Society does not maintain a library.

Subscription to the Journal must be paid in advance. The subscription rate is so low that second notices are not ordinarily sent out.

Payment of Canadian or other foreign subscriptions and bills must be made by international Postal Money Order or by a draft on a New York bank and payable in U. S. A. dollars.

Subscribers are urged to give us their full cooperation in these matters.

Subscriptions should be sent to the Secretary-Treasurer, Entomology Department, Kansas State College, Manhattan, Kansas.

Subscriptions in the U. S. A.,	**$1.50 per year**	**Single Copy**
Canadian or foreign subscriptions,	**1.75 per year**	**60 cents**

Vol 14, No. 3, July, 1941

VOL. 14 OCTOBER, 1941 NO. 4

Journal

OF THE

Kansas Entomological Society

PUBLICATION COMMITTEE

PAUL B. LAWSON, Editor, Lawrence

R. H. BEAMER, Lawrence R. H. PAINTER, Manhattan

DWIGHT ISELY, Fayetteville, Ark.

JAMES WALKER McCOLLOCH

1889-1929

Entered as second-class matter June 7, 1939 at the Post Office at Manhattan, Kansas, under the Act of August 24, 1912

Kansas Entomological Society

Volume 14 October, 1941 Number 4

A REVISION OF TWO GENERA OF NORTH AMERICAN CERCOPIDAE (HOMOPTERA)

KATHLEEN C DOERING, Lawrence, Kansas*

(Continued from the July issue)

Aphrophora parallela (Say) 1824

As **Ptyelus cribatus**, Walker, List Homoptera British Museum III, p. 712, 1851. Stal. Of. Vet. Akad. Fork. XIX, p. 493, 1862.

Comparative Notes. This species is one of the most distinctive species in the genus. Both male and females are equally distinguishable by the bulbous postclypeus which is inflated to such an extent that it protrudes considerably beyond the frons in dorsal view of head. Moreover, the head is long and conical, extending beyond the eye a distance greater than length of eye from anterior angle to posterior angle and its median length is greater than one-third of greatest width of head, which makes the head proportionally narrower than in other species.

The male genital plates are more similar to **canadensis, punctipes, saratogensis, detritus** and **salicis.** These six species show differences in the relative length of the plates and the eighth and ninth sterna. In **parallela** and **canadensis** the plates are broader than in the other species, with their lateral margins expanded, and the ninth sternum is much longer than either the plates or the eighth sternum. In **parallela** the ninth sternum is not quite twice the median length of the eighth, while in **canadensis** it is more than twice the length of the eighth. In **saratogensis, punctipes** and **salicis** the ninth sternum is shorter than either the plates or the eighth sternum. These five are separated by the fact that the greatest length of the genital plate is at the outer margin in **saratogensis** and **detritus**, the midline in **salicis**, and mesad of midline in **punctipes.** Also that the plates and ninth sternum are sub-equal in **saratogensis** and **detritus**, the plates over twice longer than the ninth sternum in **punctipes**, and the plates about one-third longer in **salicis. Saratogensis** and **detritus** are then separated as given in the key to males. A comparison of the drawings will show these differences at a glance.

Distribution and Host Plant Records. In the literature this species is known as the Pine Spittle-bug. Fitch recorded nymphs feeding on pine. Ball (1928) stated that of the species known to him, he believed that this was the only one whose nymphs fed on

pine. Host plants listed have been white pine, **Pinus strolus,** scotch pine, **Pinus sylvestris,** and hemlock (Van Duzee). R. H. Beamer reports collecting adults on **Pinus banksiana,** the gray or northern scrub pine. Say (1824) described this species as **Cercopis parallela** and stated that it inhabited Northwest Territory. A footnote in his description states that it also occurs in Missouri and Arkansas. Ball (1898) pointed out that Say's specimens from these last two places were **irrorata** Ball, which was described in 1898.

Other references are as follows:

Ball (1895). Ontario, New York, Pennsylvania, Vermont, Massachusetts, Maryland, West Virginja, Michigan.

Ball (1934). (North East) from Nova Scotia and Ontario to northern Wisconsin and northeastern Minnesota, south in the Appalachians to Ohio, West Virgmia and Maryland. Apparently restricted to pine region around the Great Lakes and the upper part of Appalachian Mountains.

Fitch, Asa (1851). New York as **Lepyronia.** Nymphs on pine.

Glover, (1877). Found on white pine and supposed by the negroes to produce forest flies.

Goding, F. W. (1895). Illinois and Pennsylvania.

Harrington (1889). Ontario, Can.

Harris, J. W. (1862). Massachusetts.

Lintner, J. A. (1889). New York. On white pine.

McAtee, W. L. (1919). Washington, D. C. (Maryland).

Provancher, Leon (1885-1900). Canada.

Smith, John B. (1910). "Throughout state of New Jersey on white and pitch pine and probably infests other species; sometimes not rare."

Stearns (1923). New England states, New York, New Jersey, Ohio, Michigan, Ontario, Wisconsin and Minnesota.

Surface, H. A. (1907). Pennsylvania.

Uhler, P. R. (1885). White pine.

Van Duzee, E. P. (1889). "Common on pines in Muskoka Lake District of Canada."

Van Duzee, E. P. (1894). "Common on pines, Ridgeway, Ontario, in August. Taken everywhere where white pine grows. On hemlock at Lancaster and Colden.

Van Duzee, E. P. (1906). Near Lake Temagami, Ontario.

Van Duzee, E. P. (1908). Quinze Lake, Province of Quebec.

Walker, Francis (1851). As **Ptyelus cribatus.** Nova Scotia.

Wirtner (1904). Erie, Pennsylvania, on pines, in July and August.

The states in which this insect has been collected according to authors are: Connecticut, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Nova Scotia, Ohio,

Ontario, Pennsylvania, Quebec, Vermont, West Virginia Wisconsin. The present writer has studied male specimens only from Connecticut, Michigan, Massachusetts, Maine and Wisconsin; female specimens without males to verify them from Minnesota and Pennsylvania.

Aphrophora quadrinotata Say 1831

As **Aphrophora fascialis** Walker. Walker, Francis, Insects Saundersiana (Homoptera) pp. 1-117, 1858.

Comparative Notes. This is a unique and easily recognized species. It is usually recognized by the presence of two distinct whitish spots on the costal margin of each tegmen and from which it gets its name. The male genital plates are not like those of any other of the North American species.

Distribution Notes and Host Plant Records. Say in the original description stated that this species inhabited the United States. The following records are found:

Ball (1898). This is the most abundant of the eastern species. Ontario, New York, New Hampshire, District of Columbia, Maryland, West Virginia, Georgia, Florida, Iowa and Nebraska.

Barber (1914). Florida.

Fitch (1851). New York, on grapes.

Glover (1876). Maryland, on grapes.

Goding (1895). Pembina, North Dakota (Uhler), Illinois (Forbes).

Lintner (1889). Common in New York.

McAtee (1919). Washington, D. C.

Metcalf (1915). North Carolina.

Osborn (1921). Florida.

Packard (1878). Maine, on grave vines.

Provancher (1885-1900). Canada.

Saunders (1883). Spittle masses on branches of grapes in June.

Smith (1890). New Jersey.

Smith (1910). New Jersey at Newfoundland, Westfield, Staten Island, Orange Mts., Lakehurst and Shark River.

Stearns (1923). New England states, New York, New Jersey, Maryland. Virginia, District of Columbia, Tennessee, Ohio, Ontario, Wisconsin, Minnesota, Iowa and Kansas.

Uhler (1878). North Dakota, Turtle Creek.

Van Duzee (1889). Very abundant Muskoka Lake, District of Canada.

Van Duzee (1894). Buffalo, New York and vicinity.

Van Duzee (1905). Adirondacks. Occasional.

Van Duzee (1908). Quinze Lake, Province of Quebec. Common form.

Van Duzee (1919). Catalogue. Quebec, Ontario, Maine, New Hampshire, Massachusetts, New York, New Jersey, Pennsylvania, Maryland, District of Columbia, North Carolina, Georgia, Florida, Ohio, Illinois, Iowa, North Dakota, Nebraska.

Walley (1928). Connecticut, New York, Ontario and Iowa.

Wirtner (1904). Pennsylvania, Erie, Patton, Greensburg, Pittsburgh.

The writer has seen specimens from the following places: Hamden and Mystic Cave, Connecticut; Cheboygan County, Michigan; Two Harbors, Minnesota; Douglas County, Kansas; St. Paul, North Branch, Eveleth and Shevlin, Minnesota; Vineland, Ontario; Ithaca, New York; Ames, Iowa; Herod, Illinois; Tokio, North Dakota; Schuqualak, Mississippi; Elgin, Alabama; Clarksville, Tennessee; Arlington and Hampshire County, Massachusetts; Fryeburg, Maine; Fish Creek, Wisconsin; and Deepdale, Manitoba.

The summary of the states from which this insect has been collected is: Alabama, Connecticut, Georgia, Florida, Illinois, Iowa, Kansas, Maine, Manitoba, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Ontario, Pennsylvania, Quebec, Tennessee, Virginia, Washington, D. C., West Virginia, and Wisconsin.

The host plants of the species are probably many. Fitch and several others report finding nymphs and adults feeding on grape. Ball (1901) mentions various plants and shrubs and in 1915 stated that it is the common species on grass and low vegetation where spittle masses are often so abundant in meadows as to be a nuisance. Van Duzee (1894) stated that they were common about bushes and weeds, especially deep woods, and Wirtner (1904) found them on small trees and weeds near neglected fields. Richard Schwitzgebel, Kansas State College, found nymphs on **Veronia interior**, ironweed.

Glover, (1876) made the following interesting statement about parasitism: "Insects of the genus are carried off by a Hymenopterous parasite **Gorytis** to provision its nest and serve as food for the young."

Aphrophora saratogensis (Fitch) 1851

As **Ptyelus gelidus**, Walker, List Homop. III, p 713, 1851. Stal, Of. Vet. Akad, Fork. XIX, p. 493, 1862.

Comparative Notes. Fitch described this species as a **Lepyronia.** In 1856 he pointed out that this is an **Aphrophora** because the ocelli are closer together than to the eyes, which easily separates it from **Ptyelus**, that it has long, narrow wings, an angular notch in the base of their heads, a pale stripe, slightly elevated along middle of head and thorax.

Typical forms are easily recognized by the broad, median white vitta on head and pronotum. Darker specimens have the dorsal vitta almost obsolete as Fitch pointed out and other specimens graduate between the two. These latter variations are confused with **punctipes** and **canadensis** Walley. For a comparison of structure of these three species see the discussion of **punctipes.**

Aphrophora saratogensis is more closely related to **Aphrophora detritus** Walker than other species. In the literature to date **detritus** has been made a synonym of **saratogensis** and the distribution records are consequently somewhat confused. The species can usually be separated by color; **detritus** lacks the broad white head and pronotal stripe of the typical **saratogensis**, has the antero-lateral borders of the vertex light bordered, with about six, small blackish-brown spots, placed at the extreme margin and the elytral punctures have a larger, encircling brown ring.

Structurally they are separated by the median length of vertex, being longer than the lateral margins of the pronotum in **saratogensis,** but equal in **detritus**; by the median length of head being nearly one-half median length of pronotum in **saratogensis**, but much less than half the pronotal length in **detritus**; differences in genitalia are pointed out in the key.

In the terminal abdominal structures of the males **saratogensis** resembles **detritus** Walker, **parallela** (Say), **canadensis** Walley, **punctipes** Walley and **salicis** DeGeer. For a comparison of these structures in the six species, see the discussion under **parallela** and the drawings on page 124.

Distribution and Host Plant Records. The following records are found in the literature:

Ball (1898). Specimens at hand from Ontario, New York, New Hampshire, Washington, D. C., Maryland and West Virginia.

Ball (1928). Adults on pine in Wisconsin, Massachusetts and Virginia. Nymphs never on pine. In Florida nymphs abundantly on ferns beneath the pine.

Ball (1934). Abundant along the Appalachian mountains from Ontario and Nova Scotia to southern Florida, west through Pennsylvania and New York to northern Wisconsin, where it is abundant in the pine barrens, then to Vancouver and California. This range includes **punctipes** and **canadensis** Walley.

Barber (1914). Florida.

Fitch (1851). Adults on pitch pines and white pines on sand plains at Saratoga.

Goding (1895). New York, New Jersey, Ontario, Nova Scotia and Florida.

Metcalf (1915). North Carolina.

McAtee (1919). Vicinity of Washington, D. C.

Osborn (1921). Florida.

Smith (1910). Newfoundland, Staten Island, Jamesburg, Farmingdale, Lakehurst, Malaga and Brown Mills, New Jersey.

Stearns (1923). New England states, New York, Maryland, Washington, D. C., Wisconsin and South Carolina.

Van Duzee (1889). Muskoka Lake, District of Canada.

Van Duzee (1894). Hamburgh, Salamanca and Buffalo, New York. Beaten from pines.

Van Duzee (1906). Lake Temagami, Ontario.

Van Duzee (1909). Florida.

Walker (1851). Florida and Nova Scotia.

The states in which this species has been collected according to authors and which unquestionably are **saratogensis** are: Connecticut, Manitoba, Masachusetts, Michigan, Minnesota, Newfoundland, New Hampshire, New Jersey, New York, Nova Scotia, Ontario and Wisconsin. In the Snow Entomological collection is a large series of male and female specimens, both light and dark, from the following places in Minnesota: Shevlin, Eveleth, Willow Springs, Bena and Itasca Park, all collected as adults on **Pinus banksiana** and Tamarack or the evergreen tree of the North. Males have been identified by the writer from Cheboygan County, Michigan, Manitoba, Illinois, Connecticut and Wisconsin. A large series from Cartwell Cliffs, Ohio is in the Ohio State collection.

Records of states which have been given in the literature, but which probably refer to **detritus** Walker, are Florida, Georgia, Maryland, Mississippi, North Carolina, South Carolina and Washington, D. C.

Present studies seem to show that the southern records given above probably refer to **detritus** Walker instead of **saratogensis**. Recent collecting of large series of specimens in the north indicates that **saratogensis** follows the distribution of **Pinus banksiana** and Tamarack through the northern states. The range of these species is given west and northwest of southern Ohio, Illinois and New York. It is probable that all previous records from southern areas are **detritus** Walker. The latter is not a common species apparently, judging from the few which have shown up in collections, while **saratogensis** is abundant.

Host plants for the adults are pines and Tamarack (larch). Fitch mentioned white and pitch pines, while the large Minnesota series collected by R. H. Beamer, was taken from **Pinus banksianna** (scrub pine) or Tamarack. Dr. Ball (1928) stated that nymphs were never found on pine, but that he had taken them in great abundance on ferns beneath the pines.

Aphrophora signoreti Fitch 1851

Comparative Notes. Superficially resembling **saratogensis** in size, but differing from the typical **saratogensis** by lacking the broad light stripe on head and thorax and by having the lateral margin of vertex between eye and frons much shorter than in the latter. Ball states that it is slightly smaller than **saratogensis** with a shorter, blunter vertex and stronger front. In the key to the female this species runs down close to **salicis** DeGeer, but is separated by having a more rounded instead of the conical head of **salicis**, and by its darker, mottled markings, while **salicis** is uniform tawny.

The male genital plates are more similar to **annulata** Ball than any other species. Here distribution comes into significance, for **annulata** is a limited and rare western species, while **signoreti** is a limited and rare northeastern species. **Signoreti** has the pronotum and lateral margin of the vertex proportionally shorter than in **annulata.** The differences of the male genital plates can more quickly be compared by studying the drawings, the main differences being that in **signoreti** they form fingerlike processes, tapering somewhat at apex, and with the outline of the space between more triangular, whereas in **annulata** the plates are shorter, truncate and darkened at apex, with the outline of the space between them forming a broad arc.

Notes on Distribution and Host Plants. Fitch described the species as a New York insect, feeding on grape, but gave no exact localities. The following records occur in the literature:

Ball (1898). Specimens at hand from New York and Ontario.

Ball (1928). "Species rare in collections. Reported from Ontario, New York and North Carolina. Evidently restricted by Appalachian food plant."

Goding (1895). New York (Fitch).

Lintner (1889). New York. On grapevine.

Metcalf (1915). North Carolina, June 4000-4500 feet.

Saunders (1883). On grape. In book on fruit insects.

Smith (1910). New York and probably New Jersey.

Van Duzee (1908). "A rare species. Providence of Quebec (Quinze Lake Region). I have one specimen taken by Professor Houghton in the Adirondacks and a male by Dr. Brodie at Toronto, Ontario."

Van Duzee (1919). Catalog: New York, North Carolina and Ontario.

Walley (1928). Salamanca, New York and Muskoka, Ontario.

Ball (1934) stated that this is a rare species and that the earlier collected material all came from a restricted district in the peninsular region of Ontario east of Lake Huron. Furthermore, he states, "Miss Doering has recently reported this species from Michigan; an

examination of her material (and that which she reported as **permutata**) gives the following additional records: Huron 8-8-26, Douglas Lake 7-12-30, Cheboygan 7-17-30, all localities along the shore of Lake Huron in the 'Thumb' of Michigan and just across from the region of abundance in Ontario. Miss Doering also records this species from South Dakota, but the material proved to be a female of **irrorata** which is abundant in the Black Hills. The writer has collected in southern and western Michigan and extensively in Wisconsin without finding this species. The known distribution is therefore limited to the peninsula region of Ontario and the opposite shores of Lake Erie or Ontario in New York."

The writer has seen males only from Douglas Lake, Huron and Cheboygan County, Mich'gan, and Burch River, Manitoba. She still regards the female specimen from Game Lodge, South Dakota as this species instead of **irrorata** and has another dark female from Rocky Mountain Park, Colorado, and one from Itasca Park, Minnesota, which she believes to be this species.

The states given for this species at present are: Ontario, New York, North Carolina, Michigan, South Dakota and possibly Minnesota and Colorado.

Several writers have mentioned nymphs collected from grape. Ball (1934) stated that adults are taken on pine and nymphs from grape.

Aphrophora detritus Walker 1851

As **Aphrophora saratogensis** Fitch.

Ball, E. Entomological News, Vol. XLV: 178, 1934. (In part).

McAtee, W. L. Proc. Biol. Soc. of Wash. 33: 171-176, 1919.

Metcalf, Z. P. Jr. Elisha Mitchell Sci. Soc. XXXI, 1915. (In part).

Osborn, Herbert. Florida Entomologist V: 2-19, 1921.

Van Duzee, E. P. Bul. Buf. Soc. Nat. Sci. IX: 204, 1909.

Comparative Notes. Structurally **detritus** Walker is more similar to **A. saratogensis** Fitch than any other species, having been considered a synonym of that species. For differences between the two see the notes under that species. The writer has not seen the type of **detritus** and as Walker's descriptions are none too distinctive, the establishment of the validity of Walker's species may be questionable. However, since specimens at hand check fairly well in color, structure and distribution, it seems very likely that this was Walker's species.

Description and Host Plant. Since this species has been considered a synonym of **saratogensis** it is difficult to be certain of the past records. Since the host plants of **saratogensis** established in recent years are chiefly **Pinus banksiana** and Tamarack, both common evergreens, living in the cold swamps of the northcentral and northeastern regions of the United States and on north to Labrador,

it seems logical to assume that records south of this area would more likely refer to **detritus** Walker, the type range of which was Florida. On this basis the following state records in the literature are assigned to **detritus**: Florida, Georgia, Maryland, Mississippi, North Carolina, South Carolina and Washington, D. C.

The writer had available for study seven specimens, representing the following localities: Ozone, Arkansas; Erida, Florida; Okefenokee Swamp and Prattsburg, Georgia, Fulton, Mississippi and Walnut, North Carolina. Only one of these was a male, the specimen from Prattsburg, Georgia.

From the scarcity of specimens in collections, it would seem that this is not an abundant species such as **permutata** of the west or **parallela** and **saratogensis** of the northeast.

Aphrophora permutata Uhler 1875

Comparative Notes. A common western species, varying considerably in color from tawny to dark gray-brown, but the males are readily distinguished from other species, except **maculosa** and **fulva** by the long, contingent, finger-like genital plates. In coloring and general appearance it is very difficult to distinguish from **irrorata** Ball, whose male genital plates are broad, short and divergent. Ball, himself, in 1895 stated that **irrorata** resembled **permutata** a great deal and distinguished them by the genital plates and only one other structure, namely that the frons (postclypeus) of **permutata** meets vertex at a right angle, while the frons and vertex forms a slightly acute angle in **irrorata**. Walley (1928) in his key distinguishes them on this basis and on coloring, stating that the elytra are irrorate with dark brown in **irrorata**, but elytra of **permutata** have dark oblique bands. Stearns (1923) states that it closely resembles **irrorata** but can be distinguished by a more inflated front, vertex more narrowly rounded before, the form in general narrower and more sharply angulate behind.

In studying long series of these two species the present writer admits having difficulty in following these differences through the series. In trying to find some more concrete measurable character the only one seemed to be the longer frons of **irrorata**. It was found that the median length of the frons in this species was longer than the median length of the vertex, whereas in **permutata** the median lengths were equal.

Two new species, **maculosa** and **fulva**, which have male genital plates of the **permutata** type, are being described in this paper. The tawny coloring of these two species quite effectively sets them off from the darker **permutata**. For structural differences see the notes in the discussion of these species and in the key.

Distribution and Host Plant. Ball calls this species the common western **Aphrophora**. This seems to be, perhaps, the most abundant

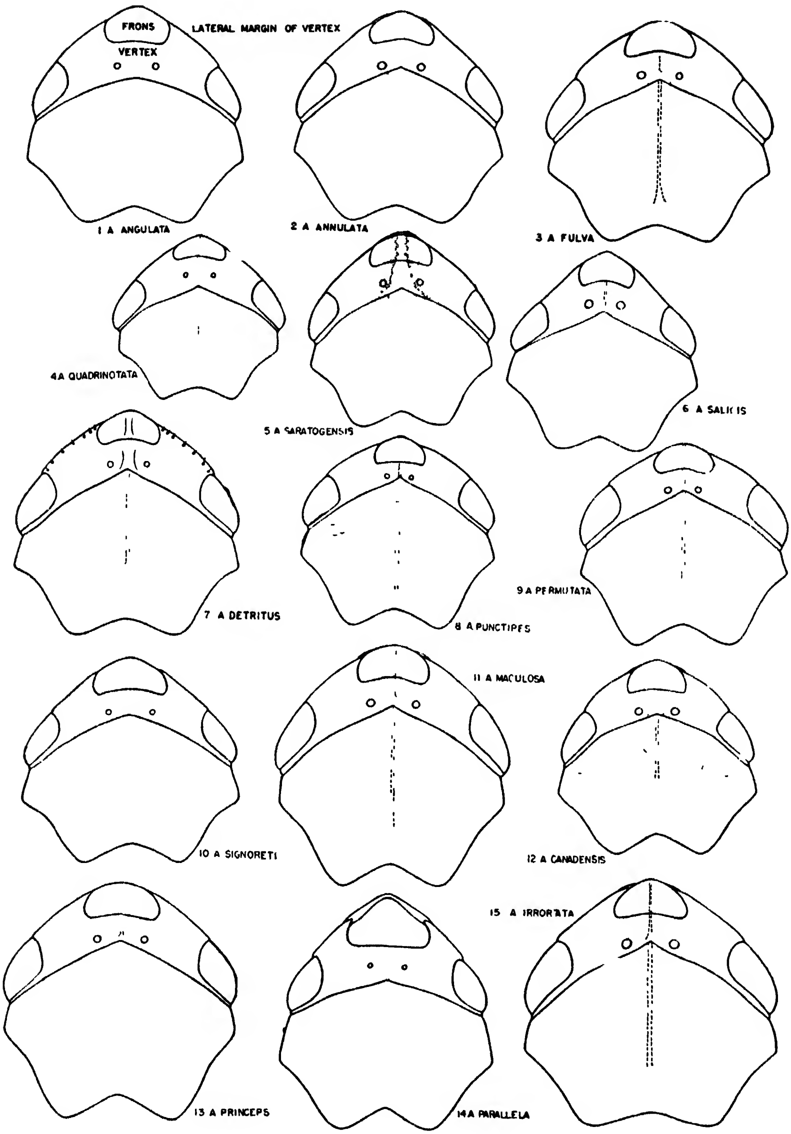

FRONS
LATERAL MARGIN OF VERTEX
VERTEX
1 A ANGULATA
2 A ANNULATA
3 A FULVA
4A QUADRINOTATA
5 A SARATOGENSIS
6 A SALICIS
7 A DETRITUS
8 A PUNCTIPES
9 A PERMUTATA
10 A SIGNORETI
11 A MACULOSA
12 A CANADENSIS
13 A PRINCEPS
14A PARALLELA
15 A IRRORATA

PLATE I

Aphrophora in the United States, the Snow Entomological Collection having hundreds of specimens, whereas in other species a couple of dozen seems a long series.

The following records have been given:

Ball (1898). Vancouver's Island, Washington, Oregon, California, Idaho, Montana and Colorado.

Ball (1934). Western mountains—abundant from British Columbia to southern California, east to Montana and Colorado, on pine. Has not been taken south of Utah or Manitou, Colorado, or east ot the main range of the Rocky Mountains.

Gillette & Baker (1895). Colorado, Manitou Park.

Goding (1895). Colorado, New Mexico, Utah and California (Uhler).

Stearns (1923). Washington, Oregon, Colorado and Montana.

Uhler (1875). Described from specimens taken in Colorado, Utah and California.

Van Duzee (1919). Catalog. Colorado, New Mexico, Utah, Idaho, Montana, California, Washington and Oregon.

The states in which this insect occurs according to authors are. Colorado, California, Idaho, Montana, New Mexico, Oregon, Utah, Vancouver Island, and Washington.

In the Snow Entomological Collection are matching males and females from many places in California, including very large series from Siskiyou National Forest, Lucerne and Monterey, several places in British Columbia, Haugan and Bozeman, Montana, Sutton, Satus Pass, and Underwood, Washington, Pingree Park, Colorado, and Culver City, Oregon. A large series of specimens in the Oregon State College collection give proof of male specimens from the following places in Oregon: Aberdeen, Bly, Sumpter, Sisters, Pinehurst, Richmond, Lacomb, Prineville, Anthena, Newport, Salem, Milton, Corvallis, Grizzly,

EXPLANATION OF PLATE I

1. Dorsal view of head and pronotum of **Aphrophora angulata** Ball
2. Dorsal view of head and pronotum of **Aphrophora annulata** Ball
3. Dorsal view of head and pronotum of **Aphrophora fulva** n sp
4. Dorsal view of head and pronotum of **Aphrophora quadrinotata** Say
5. Dorsal view of head and pronotum ot **Aphrophora saratogensis** (Fitch)
6. Dorsal view of head and pronotum of **Aphrophora salicis** De Geer
7. Dorsal view of head and pronotum of **Aphrophora detritus** Walker
8. Dorsal view of head and pronotum of **Aphrophora punctipes** Walley
9. Dorsal view of head and pronotum of **Aphrophora permutata** Uhler
10. Dorsal view of head and pronotum of **Aphrophora signoreti** Fitch
11. Dorsal view of head and pronotum of **Aphrophora maculosa** n. sp.
12. Dorsal view of head and pronotum of **Aphrophora canadensis** Walley
13. Dorsal view of head and pronotum of **Aphrophora princeps** Walley
14. Dorsal view of head and pronotum of **Aphrophora parallela** (Say)
15. Dorsal view of head and pronotum of **Aphrophora irrorata** Ball

Butte; additional female specimens from Scio, St. Helens, Lava Lake, Hood River, Sparta, Forest Grove, Summitt Prairie and Summit Bly Mountain.

Dr. Ball (1901) gives us our first data on the host plants. He found larvae in abundance on **Chrysopis villosa** and **Lupinus** sp. "These plants," he states, "grow in clumps and it was down in the base of the clumps that the larvae were found, some of them often below the surface of the ground among the roots. Often ten to 15 would be found in a single clump, their united froth masses held up by the coarse stems, reaching a diameter of two inches or more."

Although both of these plants grow very commonly over a wide extent of territory, the **Aphrophora** larvae have never been found on them except where they are within a short distance of a pine tree.

Dr. Beamer and his collecting party in 1929 observed the feeding of the nymphs of this species in Giant Forest, California. They found abundance of spittle masses on a number of host plants. They collected fully colored specimens by holding a net under the weeds and many nymphs were molting into adults. The nymph crawled out of the spittle mass, anchored itself to a stem, burst skin on dorso-median line and emerged, the process being very similar to the emergence of a cicada.

Aphrophora angulata Ball 1898

Comparative Notes. This species, along with **parallela** and **quadrinotata,** is one of the most easily recognized species in the genus. It is separated easily by its broad tegmina, with ampliate costal margin and two large, although obscure, light spots. Ball (1898) states that it is similar to **quadrinotata,** but is separated by its shorter vertex, larger size and more uniform coloring.

The male genital plates are unique, only possibly being confused with **irrorata** and **princeps.** For differences in these structures, see the key to the males and the drawings.

Distribution and Host Plant Notes. Ball described this species from a single female labeled Cal. collected by Bruner. He stated that he had seen other examples, including one bearing the MSS name **angulata** in Uhler's collection.

Other distribution records are:

Ball (1934). (Pacific Coast) found along the California coast from San Francisco south.

Burmeister (1835). Locality and identification doubtful.

Stearns (1928). San Antonio Canyon, Ontario, Santa Cruz Mts. and Alameda County, California.

Van Duzee (1914). San Diego, Lakeside and Alpine, California. From May to June. Taken on willow.

Van Duzee (1919). Catalog. California.

Walley (1928). San Francisco, California.

In the Snow Insect Collection are specimens from the following places in California: Leona Heights, Sargent, Ventura, Boulder Creek, Stimson Beach, Salinas, San Francisco, Golden Gate, Alpine, Mint Canyon and Monterey. One male from Hoquiam, Washington.

This chiefly California species has therefore been taken in one other state, Washington.

Concerning the host plants Dr. Ball wrote in 1915 that he had taken these insects in certain restricted areas along the coast where adults were collected on willows and in low situations where grasses occur. No spittle masses were ever seen on these trips. Then, another season he accidentally broke off a leaf from the Giant Umbrellifera. **Heracleum lanatum** and discovered that the enlarged sheath was full of froth and that nearly a dozen **Aphrophora** larvae were hidden in the mass. Other sheathes revealed other froth masses ranging from a single larva up to over twenty. A few fresh males were found for identification. Although this weed extends across the continent from coast to coast, the insect occurs only along the California coast.

Aphrophora annulata Ball 1898

Comparative Notes. According to Ball this species is separated from **saratogensis** and **permutata**, which occur in the same range, by its lighter ochraceous-brown color, irregularly maculated with chestnut. Structurally it is separated from **saratogensis** by the median length of vertex, being distinctly longer than lateral margin of pronotum and median length of entire head approximataely one-half median length of pronotum, while in **annulata** the median length of vertex is about equal to pronotal margin and the median length of head is considerably less than one-half median length of pronotum.

The male genital plates more closely resemble those of **signoreti** Fitch than any other species. For comparison of the two see the notes under **signoreti**.

Distribution and Host Plant Records. Ball described the species from 16 specimens taken at Wasatch, Utah. In 1915 he reported the nymphs feeding on **Artemisia ludoviciana** in Utah. In 1934 he gives the following discussion of the insect:

"Western Mountains. Higher elevation in the main range of the Rockies in Colorado and New Mexico, main range Wasatch in Utah, and the main range of the Sierras in California. Stearn's record (1923) of this species from New Hampshire and North Carolina was apparently a mistake, as he has no material in his collection and was not able to refer the writer to material in any other collection. A search of other collections has not revealed any eastern material and Dr. Z. P. Metcalf has no material from North Carolina of Stearn's

determination. Stearn's figure of the male genitalia is not typical of any species and he does not describe the genitalia but quotes the writer's description which he did not do where material was available."

The writer has examined only specimens from the Utah type series, but agrees with Dr. Ball that it is a western species. From Stearn's figure of the male genital plates it seems very probable that the New Hampshire and North Carolina specimens were **signoreti** Fitch.

The states from which this species has been taken without question are: California, Colorado, New Mexico and Utah.

The host plants as given by Ball are adults on pine and nymphs on **Artemisia ludoviciana** or sage.

Aphrophora irrorata Ball, 1898

Comparative Notes. A local western species, usually in size larger than other members of the genus. This species is difficult to distinguish from the abundant western species, **permutata**, except in the male genital plates which fortunately are vastly different. See the discussion concerning these two species in the notes under **permutata.**

The male genital plates are similar to two other species, **angulata** Ball and **princeps** Walley. In fact Ball (1934) considered the latter species to be synonymous with **irrorata**, stating that differences which Walley pointed out were due to a difference in the tilting of the male plates. Differences in the plates of these three specimens are given in the key to the males and can readily be seen at a glance in the drawings. **Princeps** is further distinguished from **irrorata** by its smaller size, longer, narrower pronotum, and shorter head which at middle is a little less than one-fourth total width of head. **Angulata** is easily separated from **irrorata** and **princeps** both by having broad tegmina, with ampliate costa and two large light spots along the costal region.

Dr. Ball in the original description states that it resembles **parallela** closely in color and markings and was probably the one referred to by Say as occurring in Missouri and Arkansas. **Parallela** is readily distinguished by its large, inflated postclypeous and long vertex.

Distribution and Host Plant Records. The following records are found in the literature.

Ball (1898). Described from examples from Sioux County, Nebraska and Ft. Collins, Colorado.

Ball (1934). "Black hills region of Dakota and Nebraska, higher mountain regions of Colorado and Utah and the coast region of British Columbia and Washington, south of Central Arizona and

California mountain regions." This, however, includes **princeps** Walley.

Stearns (1923). Colorado and Nebraska.

Snow (1904). Arizona.

Van Duzee (1903). Beulah, New Mexico.

Van Duzee (1919). Catalog. Nebraska, Colorado, New Mexico, Arizona, California, British Columbia.

Walley (1928). Nebraska, Colorado. He states that Van Duzee's records from California and British Columbia may be **princeps** Walley or **permutata** Uhler.

In the Snow Entomological Collection male specimens are on hand from Little Beaver Creek, Poudre River Canyon, and El Paso County, Colorado; Zion National Park, Utah; Huachuca Mountains, Santa Rita Mountains, Chiracahua Mountains, Granite Dell, and Coconimo County, Arizona; and Cloudcroft, New Mexico. Female specimens only have been collected from southern Arizona, Flagstaff, and Oak Creek Canyon, Arizona; Sargent, California; Magdalena Mountains, New Mexico; Pingree Park, Manitou, and Glenwood Springs, Colorado; Newaygo, Canada.

The unquestioned state records for this species are Arizona, Colorado, Nebraska, New Mexico, South Dakota, and Utah. The California, Canadian and Washington records are still doubtful, since only females have been found, or **princeps** might be included.

In regard to host plants Ball (1934) states that adults have been taken on pine and no nymphs have been observed. The Pingree Park female was taken on aspen, probably accidentally lodged there from a nearby pine.

Aphrophora salicis DeGeer

Comparative Notes. A slender, light colored **Aphrophora.** Body colored and tegmina golden tan with uniform dark brown punctures, no conspicuous light and dark areas. Structurally distinguished by its long, pointed head, its median length being about one-third its width, and its flattened postclypeus which meets the frons at a small acute angle.

The male genital plates are long, roundingly pointed spatulate projections with their lateral margins parallel and not extended fanwise and their apices midway of each lobe. For comparison of the genitalia of similar species see the discussion under **Aphrophora parallela.**

Distribution and Host Plants. This is one of the common species of **Aphrophora** in Europe. According to Metcalf and Barber (1929) it was introduced into the United States or at least was found here in 1921, feeding on various species of willow, **Salix petiolaris, Salix nigra,** in the Arnold Arboretum. These authors made life history studies

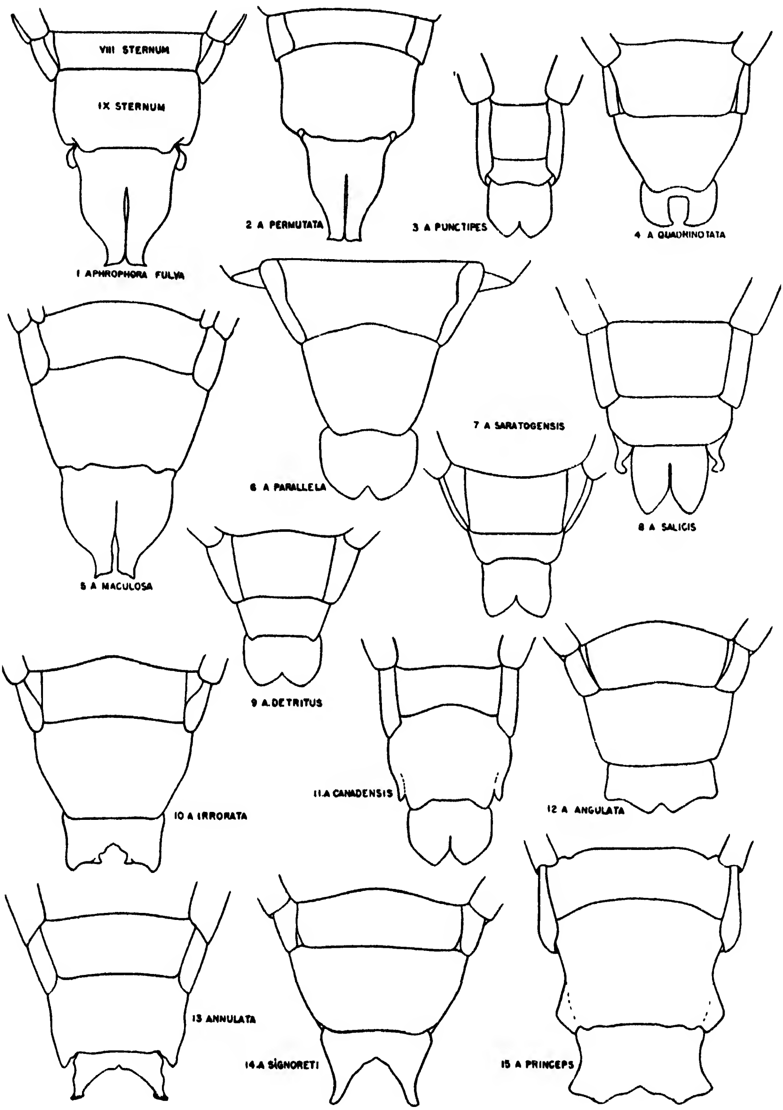

VIII STERNUM
IX STERNUM
1 APHROPHORA FULVA
2 A PERMUTATA
3 A PUNCTIPES
4 A QUADRINOTATA
5 A MACULOSA
6 A PARALLELA
7 A SARATOGENSIS
8 A SALICIS
9 A.DETRITUS
10 A IRRORATA
11.A CANADENSIS
12 A ANGULATA
13 ANNULATA
14.A SIGNORETI
15 A PRINCEPS

PLATE II

in the summers of 1923 and 1924 and found that the eggs were laid in the terminal twigs of the willow and that the nymphs clustered together while feeding, thus forming large spittle masses.

Aphrophora princeps Walley 1928

Comparative Notes. A small, uniformly dark punctured species, superficially in size and general appearance resembling **punctipes** and **canadensis** Walley. Its male genital plates however, are more similar to those of **irrorata** and **angulata**. For a comparison with these two species, see the characters in the key to the males and the comparative notes under the discussion of **irrorata.**

It is separated from **punctipes** and **canadensis** by the median length of the head, which is one-fourth the total width of the head in **princeps**, distinctly more than one-fourth in **canadensis** and distinctly less than one-fourth in **punctipes.** In the key to the females this species runs down for some peculiar reason close to **maculosa** and **fulva** which are of the **permutata** type. The latter are easily separated by their tawny, lighter color.

Distribution. Described from holotype male and allotype female, Washington. Walley stated that it occurs in the same locality as **A. permutata** Uhler.

The present studies indicate that it is a far western species but does not have the wide range or occur in such numbers as **permutata.**

The writer has seen male specimens from Fort Seward, California, Victoria, Vancouver, Friday Harbor, Oregon and Hoquiam, Washington.

Th's species, then, as recorded occurs only in California, Oregon, Vancouver and Washington.

Aphrophora punctipes Walley 1928

Comparative Notes. In 1934 Doctor Ball wrote a brief revision of the genus **Aphrophora** in which he stressed geographical range of

EXPLANATION OF PLATE II

1. Ventral view of male genital plates of **Aphrophora fulva** n. sp
2. Ventral view of male genital plates of **Aphrophora permutata** Uhler
3. Ventral view of male genital plates of **Aphrophora punctipes** Walley
4. Ventral view of male genital plates of **Aphrophora quadrinotata** Say
5. Ventral view of male genital plates of **Aphrophora maculosa** n sp.
6. Ventral view of male genital plates of **Aphrophora parallela** (Say)
7. Ventral view of male genital plates of **Aphrophora saratogensis** (Fitch)
8. Ventral view of male genital plates of **Aphrophora salicis** DeGeer
9. Ventral view of male genital plates of **Aphrophora detritus** Walker
10. Ventral view of male genital plates of **Aphrophora irrorata** Ball
11. Ventral view of male genital plates of **Aphrophora canadensis** Walley
12. Ventral view of male genital plates of **Aphrophora angulata** Ball
13. Ventral view of male genital plates of **Aphrophora annulata** Ball
14. Ventral view of male genital plates of **Aphrophora signoreti** Fitch
15. Ventral view of male genital plates of **Aphrophora princeps** Walley

the various species and chiefly because of this placed three species in synonomy, namely **punctipes, canadensis,** and **princeps** described by Walley (1928). He considered **punctipes** and **canadensis** to be synonyms of **saratogensis** Fitch, thus making the range of the latter extended from Florida to Vancouver. The present writer in a synopsis of the North American Cercopidae (1930) had merely accepted Walley's species without question, since little material was available for careful study. Since that time fairly large series have been collected and the validity of Walley's species can be established. It is still true that female specimens of **punctipes, saratogensis** and **canadensis** are not easily separated, but this is also the case with other species in the genus. Typical specimens of **saratogensis** which have the unique broad cream stripe on head and pronotum are easily separated, but darker specimens are found which have this less pronounced or even almost lacking. **Punctipes** and **canadensis** are always dark, uniformly punctured species with only a narrow pale median stripe. Structurally females are separated by the longer vertex of **saratogensis**, which is distinctly longer than the lateral margin of the pronotum, whereas in the other two it is not as long, or only slightly so, and by the median length of the head being approximately one-half median length of pronotum in **saratogensis** and **canadensis**, but considerably less than one-half length in **punctipes.**

Male specimens of the three species are separated by the terminal abdominal structures, which are discussed under the notes concerning **parallela.** In addition, the males are easily distinguished by the following differences in head structures: the width of the frons of **canadensis** is less than twice its median length, in **saratogensis** and **punctipes** it is twice this median length; the median length of the vertex in **saratogensis** is longer than median length of frons, equal in **canadensis**, and less than length of frons in punctipes.

Distribution. Walley described this species from a single male holotype and female allotype taken in Washington. He states that it occurs in the same locality as **permutata** Uhler. Since **permutata** is one of the most common and widely distributed western species, this is somewhat misleading, since the distribution of **punctipes** at the present date is much more limited. Doctor R. H. Beamer collected nine females and eighteen males from Monterey, California, in July and August. This great preponderance of males is unusual for this genus.

Aphrophora canadensis Walley 1928

Ball, 1934, As **A. saratogensis.**

Comparative Notes. In the original description Walley states that it can be readily distinguished from **saratogensis** by the male

genital characters and by the absence of the pale pronotal stripe. From **annulata** and **signoreti** by its longer vertex. It is most closely related, he states, to **punctipes** which has similar male genitalia, but differs in shape and punctuation of the pronotum. This difference in punctuation is difficult to follow from the original descriptions. In regard to the pronotum he states that the posterior margin of **canadensis** is constantly angulate and the median carina obsolete on apical half of pronotum, while **punctipes** the posterior margin is broadly and roundingly emarginate and carina entire.

The present writer finds that **canadensis** is a dark species, fairly uniformly punctate, and is easily confused with **saratogensis** Fitch and **punctipes** Walley. For distinctions in body structure and color see the notes under the discussion of **punctipes**.

In the terminal abdominal structures it resembles **saratogensis, punctipes, parallela** and **salicis**. For a comparison of the differences in these two structures, see the discussion under **parallela** and the drawings.

Distribution. Walley described the species from specimens taken at Victoria, British Columbia. He mentions having fifty-seven specimens on hand.

In the Snow Entomological Collection is a large series of males and females, collected at Monterey, California, one male from Siskiyou National Forest, California, and one female from Goldstream, British Columbia.

Aphrophora fulva n. sp.

Original Description

Size. A medium-sized **Aphrophora.** Length of body, females 11 mm. to 11.88 mm., male 8.8 mm. Greatest width of body across tegmina, female 3.52 mm. to 3.96 mm., male 3.3 mm.

Color. A uniform tawny color, the lightest species in the genus. Head from above uniform tawny, with a narrow, paler median stripe, flanked on each side by a broad, light brown stripe. Thorax stramineous, faintly mottled with darker tones, median carina paler. Tegmina buff background, mottled inconspicuously as follows: a narrow, white oblique band, starting at apex of mesonotum, crossing clavus and corium in a posteriorly direction and ending at about middle of tegmen on R vein, this light streak flanked anteriorly by a broad, irregular dark band; a second narrow transverse light streak extending from apex of clavus to costal border, which again is flanked anteriorly by a dark shaded, irregular band, entire apical portion of corium and a fairly large light spot on mesal border of tegmen just posterior to apex of clavus. Thorax and tegmina with amber-colored pits, centered with a dark dot. Mesonotum and veins mostly stramineous. Under side of body uniform stramineous, inconspicuously shading to dark at border of segments. Claws of legs black.

Structural Characteristics. Head angulately produced beyond eye a distance equal to length of eye or slightly less. Width of head and thorax about equal, full length of head a little more than half its width, its median length less than one-half median length of pronotum and over one-fourth combined length of head and thorax. Frons not protruding, its length equal to median length of vertex. Lateral margin of vertex slightly longer than median length of head, its median length not longer than lateral margin of pronotum or only slightly so. Anterior margin of ocelli and elevated apex of med an carina located midway of vertex. Lateral margins of pronotum diverging posteriorly; median carina conspicuous on anterior two-thirds. Mesonotum shallowly depressed through middle. Tegmina narrow, greatest width of clavus three-fifths of corium. Postclypeus not greatly inflated, meeting frons at a distinct acute angle. Male genital plates similar to those of **permutata**, united at base for one-third their length beyond which the outer margin begins to taper, thus constricting the plate just before apex to a narrow apical arm which in width is about one-third of the base.

Comparative Notes. Using the male genital plates as the most accurate character for determination, this species more closely resembles A. **permutata** and A. **maculosa**. It is easily separated from **permutata** by its paler, tawny coloration, the genital plates being much thicker and the ninth sternum proportionally much shorter. From **maculosa** it is separated by its smaller size, longer genital plates which are one-third longer than the ninth sternum in **fulva**, but are equal to the ninth sternum in **maculosa**. A. **fulva** superficially resembles A. **annulata** although the male plates are distinctly different, as can be seen in the drawings. The females are separated mainly by differences noted in the key.

Distribution and Types. Described from male holotype, and female allotype, seven male and six female paratypes, collected at Kerneville, California by Louis Kuitert, on July 24, 1940; an additional twelve male and twelve female paratypes, same data, collected by R. H. Beamer; one small male, Lucerne, California, by Jack Beamer, July 17, 1935, and another male collected by R. H. Beamer, August 10, 1938. This long series was collected on digger pine, **Pinus sabiniensis.**

Aphrophora maculosa n. sp.

Original Description

Size. A larger **Aphrophora.** Length of body, females 12.32 mm., males 11 mm. to 11.88 mm. Greatest width of body across tegmina, female 4 mm., male 3.52 mm. to 4 mm.

Color. General color golden-brown, mottled with white and fuscous. Frons light brown, with a narrow, white medium stripe. Eyes grey-brown. Vertex with spot on each side of frons, and a nar-

row median stripe light, a brown stripe on each side of carina same color as frons, rest tan with brown flecks. Pronotum stramineous mottled in fuscous and pitted with brown to black punctures. Mesonotum brown with a median stripe and all borders yellow. Tegmina indefinitely mottled, general color being light punctured with very small dark brown pits, each pit surrounded by a light brown ring; the most outstanding markings being a dark V on each tegmen, with its apex located halfway on costal border, one arm ending at the mesonotum and the other at tip of clavus, a dark spot on costal border posterior to the V and a large light area anterior to the V. Under side of body stramineous, abdomen somewhat darker. Tips of genital plates and claws on legs black.

Structural Characteristics. Head angulately produced beyond eye a distance equal to length of eye or slightly less. Head and thorax equal in width. Full length of head a little more than one-half its width, its median length not greatly more than one-third the median length of the pronotum and one-fourth the combined length of head and thorax. Frons, not protruding, its median length equal to median length of vertex. Lateral margin of vertex outwardly rounded, slightly longer than median length of head, its median length equal to or only slightly longer than lateral margin of pronotum. Anterior margin of ocelli and conspicuously elevated apex of median carina located midway of vertex. Lateral margins of pronotum almost parallel; median carina distinct on anterior two-thirds. Tegmina somewhat broader than in some species, greatest width of clavus a little over one-half width of corium. Postclypeus not greatly inflated, meeting frons at a distinct acute angle. Male genital plates similar to those of **permutata** and **fulva,** but differing greatly by being much shorter and thicker, so that combined width of plates at apex is less than width through middle and each plate equal to median length of ninth sternum.

Comparative Notes. For comparison with A. **fulva,** see notes under the description of **fulva.** From **permutata** it is separated by its lighter coloring, its more angulately produced head and the shorter male plates. From **annulata** it is separated by its larger size, greatly elevated median carina of vertex and distinct genital plates (See drawings).

Distribution and Types. Described from male holotype and female allotype and four male paratypes, collected in the San Jacinto Mountains, California, June 30, 1933, by R. H Beamer.

THE GENUS CLASTOPTERA

(Revised)

1. Few deep pronotal wrinkles or distinct bands, numbering twelve or less on median line, postclypeus generally greatly inflated ---------------------------- 2

Pronotal wrinkles many, usually numbering sixteen to twenty-five along median line, indistinct or entirely absent in **proteus** group, distinct in others; postclypeus moderately or slightly inflated, **saint-cyri** excepted -- 11

2(1). Tegmina fuscous brown with a distinct, broad, white band across clavus; wrinkles numbering eleven or twelve along median line ------------------------------ 3

Tegmina without white band; wrinkles or bands less than ten on median line -------------------------------- 4

3(2). Front longer than vertex; size smaller, between 3.5 mm. to 3.7 mm. ------------------------ **arizonana** Doer.

Front not more than two-thirds length of vertex; size larger, between 4 mm. and 4.5 mm ---- **lawsoni** Doer.

4(2). Mostly black in color ------------------------------------ 5

Fuscous and brown, striped and banded in yellow -------- 8

5(4). Black with white spot midway on costal margin; other hyaline or light markings on tegmina and face---- 6

All black above and below; front as long as or longer than vertex; length 4.6 mm. to 4.8 mm. ---- **sierra** Doer.

6(5). Postclypeus black with five or six pairs of light arcs anteriorly; tegmina with apex brownish hyaline and without clear hyaline areas around apical callous; length 3.75 mm. to 4 mm. ------------ **binotata** Ball

Postclyeus without light arcs; smaller, tegmina with more or less clear hyaline areas around apical callous---- 7

7(6). Postclypeus black except for occasionally faint indications on lateral margins --------------- **brunnea** Ball (black male)

Postclypeus with a light band across posterior margin -------------------------------- **lineatocollis** Stal (black male)

8(4). Larger, elongate, measuring 4.5 mm. to 4.9 mm. in length; front usually longer than vertex -------------- 9

Smaller, measuring between 3.4 mm. to 4.3 mm.; front usually not over two-thirds length of vertex ------ 10

9(8). Greenish yellow or sometimes washed in fuscous with white veins in sharp contrast -------- **delicata** Uhler

Bronze, or brownish, with markings more or less obscure on tegmina; arcs and spot on postclypeus more prominent -------------------------- **lugubris** Ball

10(9). Yellow and light fuscous with prominent yellow veins; postclypeus yellow with light spot or band, preceded by five or six pairs of arcs ---- **lineatocollis** Stal

Darker, with markings less prominent; face mostly all black ---------------------------------**brunnea** Ball

11(1). Face with anterior portion shining black, rest bright yellow; wrinkles shallow or sometimes scarcely discernible --12

Face uniformly yellow or brown, or anterior portion at least chiefly yellow; wrinkles deep and usually fine --19

12(11). Body elongate, cell R_6 longer than wide, clavus striped in yellow and black ----------------------**salicis** Doer.

Body globose or pear-shaped; cell R_5 about equal in length and width; variously patterned ---------------13

13(12). Body obovate, tapering at both ends equally; entirely black above -----------------------**hyperici** Gib.

Body pear-shaped, widest posterior to middle; black, variously marked above with yellow and brown --------14

14(13). Larger, over 4 mm. in length; pronotum entirely smooth or lines barely visible; dark brown, except occasionally scutellum bright yellow --------**globosa** Fowl.

Smaller insects, under 4 mm. in length; wrinkles distinct, although not deep; some yellow or light areas indicated on dorsum or tegmina ---------------15

15(14). Broad, with tegmina greatly inflated; front approximately equal to length of vertex; black band on postclypeus two-thirds or three-fifths its length --------16

Semi-elongate, pear-shaped, tegmina moderately inflated; front not more than two-thirds length of vertex; black band on postclypeus usually not more than one-half its length ----------------------------17

16(15). Yellow and black striped species---**saint-cyri** var. **saint-cyri** Prov.

All black above with brownish-hyaline apex and base of costal area --------------**saint-cyri** var. **anceps** McAtee

17(16). All yellow or washed in smoky hyaline --**proteus** var. **proteus** Fitch

Mostly black or marked with black --------------------18

18(17). Base of clavus yellow --------**proteus** var. **nigricollis** Fitch

All black above except for yellow bands on head and pronotum and hyaline apex ------**proteus** var. **osceola** Ball

19(11). Face entirely yellow or brown --------------------------20

Face yellow, variously marked with dark ---------------22

20(19). Testaceous yellow, pronotum olive green ---------------21

Mostly black marked with pale yellow ------ **testacea** Fitch (male)

21(20). Pronotal wrinkles deep, numerous, very irregular; apical callous light ------------------ **osborni** Gill. & Bak.
Pronotal wrinkles less deep, regular, numbering about twenty-five on median line; apical callous dark ------------------------------------- **testacea** Fitch

22(19). Pronotal wrinkles irregular, deep; body tapering posteriorly; striking black and yellow species **distincta** Doer.
Pronotal wrinkles regular, moderately deep; body not particularly tapering posteriorly; color pattern varied---23

23(22). Very small, less than 4 mm. in length, **arborina** and **newporta** sometimes excepted ------------------------24
Larger, always 4 mm. or over in length ---------------29

24(23). Uniformly dark brown or tannish-brown -------------25
Fuscous tan with a more or less distinct white band on clavus --26

25(24). Uniformly dark brown --**xanthocephala** var. **xanthocephala** Germ.
Yellowish brown --------**xanthocephala** var. **unicolor** Fowl.

26(24). Usually with two dark spots on vertex and a row of six dark spots on anterior margin of pronotum and sometimes a second row of four spots across disk of pronotum ----------------------------**laenata** Fowl.
Not such spots present ----------------------------------27

27(26). More slender with margins of tegmina distinctly parallel; yellow band on pronotum obscure ----**media** Doer
More robust; yellow band on pronotum very distinct------28

28(27). Smaller, brown bands on pronotum and tegmina very distinct, standing out in sharp contrast; front sometimes longer than vertex -------------**arborina** Ball
Larger, more robust, more golden in color, with brown markings less prominent, front generally equal to length of vertex ----------------**newporta** Doer.

29(23). Front at least two-thirds length of vertex --------------30
Front less than one-half length of vertex --------------33

30(29). Fuscous and brown with usually a faint oblique band across clavus and other dark brown marks on tegmina; wrinkles numbering usually between sixteen and twenty ------------------------------------31
Uniformly pale yellow with no dark markings on tegmina wrinkles numbering approximately twenty-three on median line ------------- **canyonensia** Doer.

31(30). Pronotum entirely yellow; tegmina lighter tan or fuscous with markings and apical veins dark brown in sharp contrast; band on postclypeus and spots on genae smaller ----------------**juniperina** Ball

Pronotum banded with dark; tegmina brownish-fuscous, veins and markings not particularly prominent; band on postclypeus and spots on genae large, occupying central portion of face 32

32(31). Pronotum with three brown bands .... **ovata** Doer.

Pronotum with middle brown band lacking .. **siskiyou** Doer.

33(29). Posterior half of face black or sometimes mottled, preceded by five or six pairs of arcs on postclypeus 34

Face yellow with a dark band across middle preceded by several pairs of dark arcs 36

34(33). Tegmina fuscous brown with an oblique white band across clavus 35

Tegmina uniformly bronze fuscous .... **obtusa** var. **tristis** Van Duz.

35(34). Tegmina very dark fuscous brown with a very distinct white claval band .... **obtusa** var. **borealis** Ball

Tegmina fuscous, mottled, with white claval band much less distinct, sometimes only barely discernible .... **obtusa** var. **obtusa** Say

36(33). Pronotum uniform yellow without brown markings; no white band indicated on tegmina 37

Pronotum yellow with usually two or three brown bands present or at least indicated; a white band across clavus 38

37(36). Tegmina light yellow, mottled faintly with fuscous; band and arcs on postclypeus abbreviated at sides .... **uniformia** Doer.

Tegmina mostly dark fuscous except for anterior portion of clavus, which is bright tawny yellow .... **achatina** Germar

38(36). Tegmina lighter fuscous tan with markings more distinct; median brown pronotal band broader and more prominent .... **texana** Doer.

Tegmina dark fuscous brown; median pronotal band narrow, frequently interrupted through middle 39

39(38). Usually without brown bands on anterior margins of vertex and pronotum; arcs on postclypeus very faint .... **pallidocephala** Doer.

Brown bands distinct on vertex and pronotum; arcs prominent on postclypeus 40

40(39). Brown bands on vertex and pronotum very distinct, never interrupted .... **tricincta** Doer.

Bands less distinct; median brown band in pronotum often interrupted .... **elongata** Doer.

Clastoptera globosa Fowler

Fowler, W. W. Rhynchota (Hemiptera-Homoptera).
Biologia Centrali-Americana Vol. II (part I) p. 200, 1894-1909.

Comparative Notes. This species is a large-sized **Clastoptera,** measuring approximately four and one-half millimeters in length. It is readily distinguished by the globose body, being not over one-third longer than its greatest width and its dark brown, shining body. Beyond the clavus the tegmina become light amber in color. Some specimens are striking in color due to a yellow scutellum which contrasts sharply with the dark body. The pronotum is distinctive because it lacks the customary wrinkles or has them only faintly indicated. The corium of the tegmina is inflated behind middle. The postclypeus is greatly inflated, bulb-like, with the anterior half dark brown, rest yellow, and no transverse dark bands, only faint rugosities indicated. Underside of body honey amber in color, legs same with lateral spines and ends of tarsi dark brown.

This species is not readily confused with any United States species. It is very similar in color and structure to C. **funesta** Stal, but differs, as Fowler points out, in size, being approximately four times the bulk of that species.

Distribution. Type localities were Tepetlapa and Chilpancingo, Mexico; San Geronimo, Guatemala. Specimens have recently been taken at Brownsville, Texas. One series was taken by R. H. Beamer on June 29, 1938. Another series by D. J. and J. N. Knull, August 8, 1937. The majority of the former specimens are in the Snow Entomological Collection, University of Kansas, and of the latter in Ohio State University Collection.

THE EXTERNAL ANATOMY OF THE PUPAL ABDOMEN IN **DICOSMOECUS ATRIPES** HAGEN (TRICHOPTERA, LIMNEPHILIDAE)

ARTHUR L. GOODRICH, Jr.[1]

The specimens used in the preparation of this paper were obtained, as were those utilized in two previous articles[2], from the Big Wood River, Idaho. They were fixed as pupae in Bouin's fluid, and preserved in 70 percent alcohol. Both entire specimens and those macerated in sodium hydroxide were used in the study, with and without the pupal exuviae stripped from the definitive body.

[1]Contribution No. 220, Department of Zoology, Kansas State College, Manhattan, Kansas.

[2]Goodrich, Arthur L., Jr., The thoracic sclerites of a trichopterous pupa . . . Trans. Amer. Micr. Soc., 54(1). 57-64, 1935.

——— The head capsule of a trichopterous pupa . . . Trans. Amer. Micr. Soc., 56(2): 243-248, 1937.

THE PUPAL EXUVIAE

Female: The exuviae of the abdomen are weakly sclerotized. The heaviest sclerotization is to be found in the tergum of the first abdominal segment, where a dorso-lateral shield bearing a few clusters of setae (fig. 1) replaces the spacing humps of the larval instars. Other abdominal terga are outlined anteriorly and laterally by pigmented areas, but there is little sclerotization (figs. 2 and 3). Further sclerotization of the dorsum is limited to localized areas of "chitinized plates" (Lloyd, 1921) a pair of which is found near the cephalic border of each of the third to seventh terga inclusive (figs. 2 and 3, a.s.p.), with an additional pair near the caudal margin of the fifth segment (fig. 2, p.s.p.). These plates, which more correctly should be described as sclerotized plates, bear backwardly directed denticles or hook-like spines, except those of the caudal pair on the fifth segment, whose denticles are directed cephalad (fig. 2, p.s.p.). There is no constancy in the number of denticles borne by these plates, either for different segments of the same body, corresponding segments of different specimens, or the two sides of the same segment.

Sclerotization is absent from the lateral walls of the abdominal segments, and is limited ventrally to pigmented areas bounding the sternal regions anteriorly and laterally (figs. 3 and 4).

The pupal intestine terminates at the anus, to be found just caudad of the obsolescent segmental groove forming the caudal border of the ninth segment. A pair of prominent sclerotized caudal appendages (figs. 3 and 4, c.a) terminates the exuviae. These caudal processes seem not to house any definitive structure, for no part of the adult body lies within them. The setae borne by the caudal appendages, and upon the last segment, are apparently constant in their arrangement. When the pupal exuviae are stripped from the adult body, a tube-like portion of the pupal hind-gut intima is frequently left protruding from the anal aperture of the imago (figs. 9, 16 and 17, i.i.).

The exuviae bear clusters of finger-like gills, which are usually arranged in a very definite pattern (fig. 5). The clusters have a rather fixed number of filaments, though some variation in numbers occurs. The removal of the pupal exuviae shows that the segments of the imago possess a gill-complement similar to that of the pupa (cf. figs. 5 and 10).

A prominent feature of the exuviae is the presence of the lateral fringes (figs. 3 and 4, l.f) of fine hairs, arising laterally on the fifth segment. Each fringe courses caudalward, dipping ventrally sharply on the eighth segment. The two fringes become approximated on the venter of the eighth segment.

Male. But slight differences are noted between the exuviae of male and female pupae. The areas of sclerotization are duplicated

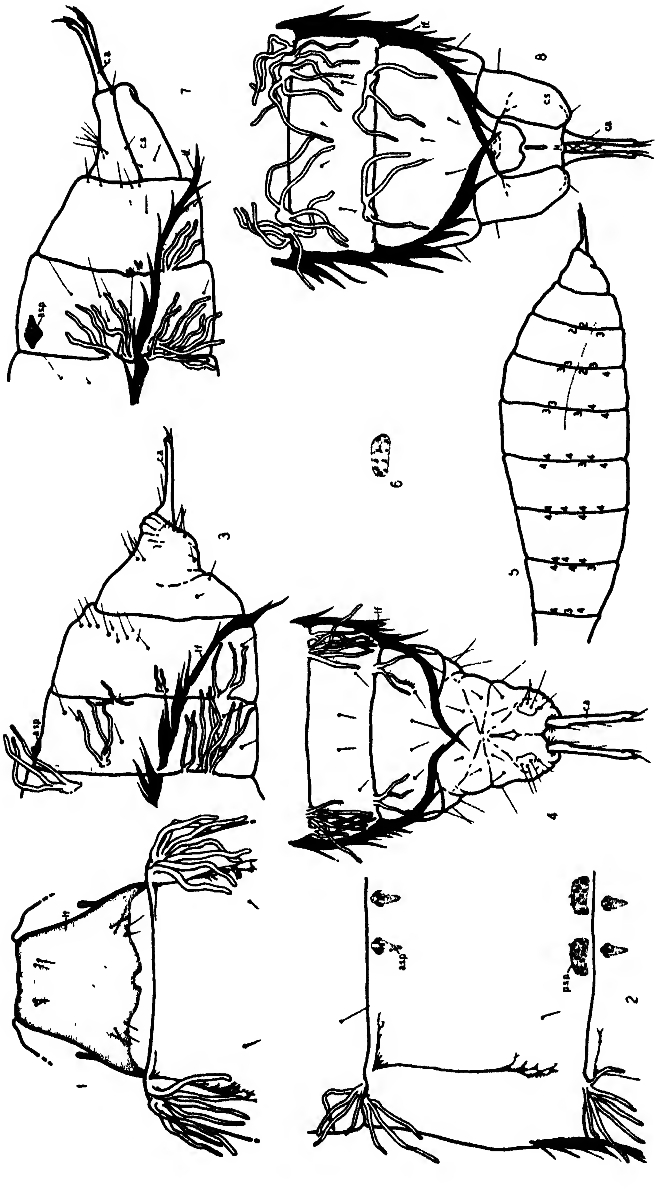


PLATE I

in the two sexes. The caudal pair of sclerotized plates on the fifth segment of the male bears fewer denticles than the corresponding plates on the female (cf. figs. 2, p.s.p and 6). The caudal tip of the male pupa differs from that of the female through the presence of ventro-lateral pouches of cuticula (fig. 7 c.s) which sheathe the claspers of the definitive insect. The male possesses a pair of scerotized caudal appendages (fig. 7, c.a) comparable to those of the female. To all appearances the gill-complement of the male is identical to that of the female.

THE DEFINITIVE EXOSKELETON

Pregenital Segments

Female. The sclerotization of the first abdominal segment is as complex as that of any pregenital segment. The tergum is sclerotized in the form of a dorso-lateral shield. The third phragma of the thoracic mechanism is an integral part of this sclerotization (see Goodrich, Trans. Amer. Micro. Soc., 54(1): 57-64, with figures). The antero-ventral angles of the tergal sclerotization are hinged under the metathoracic epimera (op. cit., fig. 4). The sclerotized portion of the sternum is represented by a pair of very slender ventro-lateral sclerites (loc. cit., figs. 3 and 4). The spiracles of the first abdominal segment are apparently atriate, with the sclerotiza-

EXPLANATION OF FIGURES, PLATE I

Fig 1 Dorsal aspect, first abdominal segment of pupal **D. atripes**
Fig 2 Dorsal aspect, left side of fifth abdominal segment of pupal **D. atripes.**
Fig 3 Lateral aspect, caudal segments of pupal female of **D. atripes.**
Fig 4 Ventral aspect, caudal segments of pupal female of **D. atripes.**
Fig 5 Plan of numbers and distribution of gill filaments, pupa of **D. atripes.**
Fig 6 Posterior sclerotized plate, fifth segment of male pupa. **D. atripes.**
Fig 7 Lateral aspect caudal segments of pupal male of **D. atripes.**
Fig 8 Ventral aspect, caudal segments of pupal male of **D. atripes.**

TABLE OF ABBREVIATIONS

ae	aedeagus	i	intima, of vesicle
an	apophysis	i c	inner cells, of vesicle
a s p	anterior sclerotized plate	i i	intima of intestine
b c	bursa copulatrix	l f	lateral fringe
b.p	bridge process	m	muscle
c	circus	ov	oviduct
c a	caudal appendage	p.p	para-anal process
c s	sheath of clasper	p s p	posterior sclerotized plate
col	collar	s	spiracle
c p	caudal process	s c	secretory cells, of vesicle
crp	crypt	s r	sclerotized ring
cxp	coxopodite	st	sternum
d a g	duct of accessory gland	set a	setous area
d b.c	duct of bursa copulatrix	t	tergum
d ve	duct of vesicle	t.a	triangular aperture, of aedeagus
d.v s	duct of vesicula seminalis	tit	titillators
f	flagellum	v	vagina (vestibule)
fl	flange	ve	vesicle
h	harpago	v s	vesicula seminalis

tion of the anterior and posterior walls of the atria having the appearance of peritremes.

The exoskeleton of the second to eighth abdominal segments inclusive is unvaried by any essential differences except that the sternum of the fifth segment bears two invaginated vesicles. These vesicles will be described subsequently. Each tergum (fig. 9, t) is most heavily sclerotized anteriorly and laterally, corresponding to the lines of pigmentation found in the pupal exuviae. The tergal sclerotization of each segment becomes progressively weaker caudally until unsclerotized cuticula is intucked at the secondary inter-segmental lines.

No pleural sclerotization independent of the sterna is to be noticed in these segments. The spiracles (fig. 10, s) in the lateral fields of these segments are atriate, with the anterior face of each atrium heavily sclerotized. The details of a possible closing mechanism utilizing this sclerotization were undetermined. The sterna (figs. 11 and 12, st) are prominent, yet not heavily strengthened, except anteriorly and laterally, with a supplemental transverse bar of pigmentation near the caudal limits of the sclerotization. The antero-lateral corners of these sterna are noticably invaginated (fig. 12, ap), suggesting that they serve as apophyses for the insertion and origin of muscle elements. As is true of the terga, each sternal area of sclerotization becomes weaker posteriorly.

The vesicular invaginations of the fifth sternum have been analyzed only from a morphological basis. No reference to vesicle-like ventral abdominal glands in Trichoptera has been found in the literature available to me. These vesicles (fig. 12, ve) exist as a pair of elongate, hollow bodies, extending cephalad into the fourth segment from their points of origin near the anterior border of the fifth sternum (fig. 12). Each vesicle is attached to its point of origin near a ventro-lateral angle of the segment by a rather delicate stalk (fig. 14, d.ve). Macerated specimens show the vesicles to be from one-fifth to one-third as long as the segment. Histological preparations of these bodies and their ducts have shown each vesicle lined by a delicate cuticle or intima which is evident also upon maceration (fig. 13, i). The cellular makeup of the walls of the vesicles, as shown in figures 13 and 14, indicates that the epidermal cells have become arranged in two layers. The outer layer is composed of very large cells whose nuclei are prominent and placed rather basally (fig. 13, s.c). The cytoplasm of these cells is somewhat vacuolate, an appearance which might be due to an artifact. It is assumed, however, that these cells represent active glandular cells, and that the vesicle serves as a reservoir for their secretions. The inner layer of cells immediately underlies the intima of the vesicle (figs 13 and 14, i.c). The nuclei are abundant, and quite small. No cell membranes are

evident in the preparations. That these cells secrete the intima of the vesicle is supported by the fact that these cells represent a layer continuous through the duct of the vesicle with the epidermis of the fifth sternum, whose cuticula is continuous with that of the vesicle and its duct (fig. 14, d. ve). Preparations indicate a prominent muscle inserts in the cuticula of each duct (fig. 14, m), suggesting that each duct is closed through the elasticity of its lining, but opened upon the contraction of muscle fibers.

Strikingly similar vesicular abdominal glands are described in the writings of Vosseler (1890) on the odoriferous glands of ear-wigs. Vosseler reports the presence in **Forficula** and **Chelidura** of two pairs of retort-like vesicles, whose contents are released through external apertures opened by the contraction of a muscle. Histologically, the lining of each vesicle is said to be covered by epidermal derivatives of two types. There are numerous small cells, whose outlines are indistinct, and fewer extremely large cells, occurring singly or in clusters on the walls of the vesicles. The essential differences between the cellular components described by Vosseler and those found in **D. atripes** lie in the relative sizes of the large components and in their distribution.

Male. No essential differences are noticed between the exoskeleton of the pregenital segments of the male and female specimens.

Genital Segments

Female. Snodgrass (1933) states that the definitive genital aperture of most female Trichoptera lies caudad of the ninth sternum. The sclerotization of the ninth sternum of the female **D. atripes** is in the form of an elongate, narrow plate, notched anteriorly and caudally (fig. 11, IXst). Ventro-laterally the ninth segment consists of weakly sclerotized areas bearing many setae (figs. 10, set.a). Each side of the ninth segment consists of a heavily sclerotized post-like area (fig. 15, pl). The sclerotization is continued across the dorsum as a less heavily strengthened narrow cross bar, which presumably represents the tergum of this segment.

The tergum of the tenth segment is represented by a triangular plate (fig. 15, Xt) whose base is attached to the sclerotized ninth tergum by a scarcely discernable suture. Caudally, this triangular area is continued as a pair of setiferous flattened caudal processes (fig. 11 and 15, c.p) which overlie and encase the anus laterally.

It is probable that the floor and lateral walls of the tenth segment have been invaginated and form a part of the very extensive ectodermal portions of the female genital tract. In 1904, Stitz summarized the available literature and published upon the genital apparatus of various Trichoptera, giving a brief bibliography of his sources. The present paper adds little to the available information, but substantiates the findings of former investigators. No attempt will be

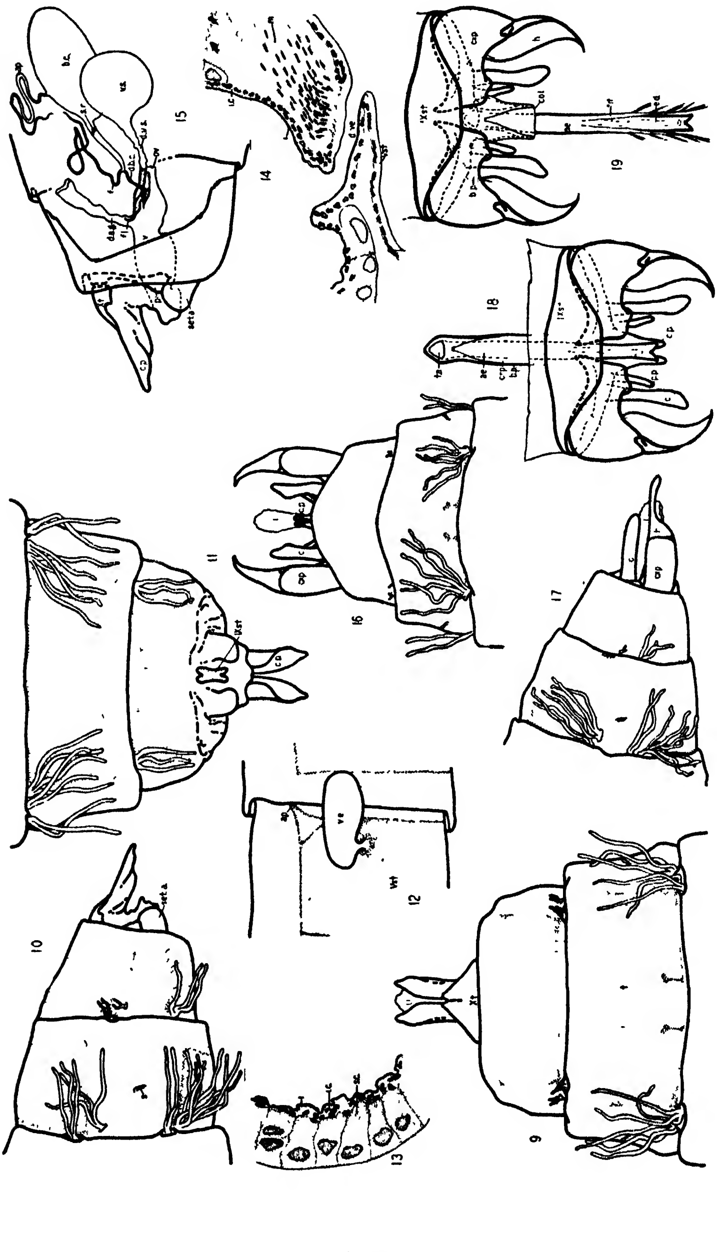


PLATE II

made to treat with the internal genitalia other than as they are represented by the intima left by maceration.

The genital aperture (oviporus) leads into an extensive vagina (vestibule) (fig. 15, v) which courses cephalad well toward the seventh segment. In cross section, the vagina is narrow and vaulted dorsally, broad and flattened ventrally, so that in cross section its dorsal and lateral extension resemble somewhat the three divisions of a clover-leaf. The antero-dorsal portion of the vagina is heavily sclerotized (stippled, in fig. 15). Antero-ventrally the vagina is believed to receive the common oviduct (fig. 15, ov). Immediately above the aperture left by the maceration of the oviduct, and anterior to the region of prominent sclerotization, arises the duct of a vesicle interpreted by Stitz (1904) as the vesicula seminalis (fig. 15, d.v.s and v.s.). The center of the sclerotized area is depressed, the depression being carried caudalward within the vagina as a tapering nipple-like structure. The tip of the nipple is pierced by an aperture leading into an elongate, slender duct (fig. 15, d.b.c) which arises from within the depression. The duct gives off a long flagellum (fig. 15 f) and continues, its lumen enlarging somewhat, ultimately to give rise to an elliptical vesicle considered by Stitz (1904) as a bursa copulatrix (fig. 15, b.c). The widening portion of the duct bears a complete or incomplete ring-like area of sclerotization (fig. 15, s.r), described by Stitz (1904) as "ein kurzer, regelförmigen Abschnitt, der von starkem gelben Chitin ausgekleidet wird und sharf abgegrentz ist." The bursa copulatrix also bears a long slender flagellum which has been termed an appendix (fig. 15, ap). A broad duct, whose walls are thrown into loose elongate folds, arises at the caudal extremity of the heavily sclerotized roof of the vagina. I have never found this duct to terminate in a vesicle, but always to end in a more or less funnel-shaped opening. This structure is considered, according to Stitz (1904), as the duct of the accessory gland (fig. 15, d.a.g). The fact that it exists as an open funnel may mean that in these preparations

EXPLANATION OF FIGURES, PLATE II

Fig 9 Dorsal aspect, caudal segments of female imago, **D. atripes.**

Fig. 10. Lateral aspect, caudal segments of female imago, **D. atripes.**

Fig. 11 Ventral aspect, caudal segments of female imago, **D. atripes.**

Fig. 12 Ental aspect, ventro-lateral angle of fifth sternum of **D. atripes,** showing glandular vesicle

Fig 13 Detail of wall of glandular vesicle, **D. atripes.**

Fig. 14 Detail of duct of glandular vesicle, **D. atripes.**

Fig 15 Lateral aspect, cuticula of internal genitalia, female of **D. atripes.**

Fig 16 Dorsal aspect, caudal segments of male imago, **D. atripes.**

Fig. 17 Lateral aspect, caudal segments of male imago, **D. atripes.**

Fig 18 Detail of sclerotization of genital apparatus of male **D. atripes,** aedeagus inverted. Titillators omitted

Fig. 19. Detail of sclerotization of genital apparatus of male **D. atripes,** aedeagus everted.

of pupae the formation of this structure has not yet reached its completion. This is substantiated by the fact that much of the intima of the internal genitalia is missing when pigment-free pupae are macerated, while the condition described in the previous paragraphs obtains in pigmented specimens, which are assumed to be more advanced in their metamorphosis.

A striking peculiarity of the strongly sclerotized roof of the vagina is that immediately dorsal to the nipple-like prominence which bears the aperture to the duct of the bursa copulatrix there exists a flange of sclerotized cuticula in somewhat in the form of the front of a toboggan. This flange (fig. 15, fl) extends upward into the duct of the accessory gland and may act as a deflector which serves to guide the copulatory organ of the male to a position over the nipple-like device bearing the aperture to the bursa copulatrix.

Male. It may be accepted that the male genital apparatus of **D. atripes** opens distally to the ninth abdominal somite. The wall of the ninth somite contains a heavily sclerotized ring, telescoped into the caudal portion of the eighth segment. The sternal sclerotization is the broadest portion of the ring (fig. 18, IXst). Laterally the sclerotization exists as two quite slender bands, broadening dorsally. Under the broader dorsum of the ninth segment, two caudal processes (fig. 18, c.p) are inset in the supra-anal region. The weakly sclerotized cuticula connecting these processes to the ninth tergum may be considered to represent the tenth tergum. Such usage is followed in Ross (1938). Thus the caudal processes of the male may be considered homodynamous with those of the female.

The claspers are two segmented: prominent setous coxopodites (figs. 17 and 19, cxp), articulated with the ninth sternum, bear bilaterally symmetrical harpagones (figs. 17 and 18, h) (Snodgrass, 1935). A pons coxalis is not evident. However, the bridge process (BP of fig. 307C Snodgrass, 1935) is probably represented by two bands of sclerotized cuticula (fig. 18, b.p) by means of which the sclerotization of the aedeagus is continuous with that of the mesal face of each coxopodite.

The aedeagus (figs. 18 and 19, ae) is elongate and tubular, and heavily sclerotized. At rest it lies encased for approximately three-fifths of its length within a deep, tubular crypt (fig. 18, crp). The tip of the aedeagus in a macerated preparation may be grasped by forceps and tugged outward to approximate the position it probably assumes when in copulation. Much of the crypt is then everted, the wall of the crypt now forming a collar (fig. 19, col) through which the aedeagus protrudes. The bridge processes (fig. 19, b.p) become twice bent upon themselves upon the extrusion of the aedeagus, as is seen by tracing the contour of the processes in Figure 19. The distal extremity of the aedeagus is truncate and notched or

cleft. The cleft occupies the vertical plane, while the truncate condition extends from a proximo-dorsal position to a disto-ventral point. Thus the aperture of the ejaculatory duct is directed dorsalward and opens through the vertical cleft at the tip of the aedeagus. In macerated specimens the proximal portion of the aedeagus, where the wall of the crypt is continuous with that of the aedeagus, presents a large triangular aperture directed ventrad (fig. 18, t.a). It is assumed that it is by way of this aperture that the vasa deferentia make union with the ejaculatory duct whose intima is evident within the distal portion of the aedeagus (fig. 19, e.d). Ventrally the central portion of the aedeagus gives rise to a pair of symmetrically arranged structures which are interpreted as titillators (fig. 19,tit).

In addition to the caudal processes of the tenth tergum and the prominent claspers, the caudal extremity of the male bears three pairs of processes. These appear not to be articulated to the ninth or tenth segment, but to exist as very prominent hollow evaginations of the integument. The members of the most prominent pair lie laterally to the caudal processes and are termed cerci (fig. 18, c), following the usage of Ross (1938). The least prominent pair lies ventrally to the anal aperture, while the evaginations of median prominence are to be found latero-ventrally to the anal aperture, and are here labelled para-anal processes (fig. 18, p.p).

LITERATURE CITED

Goodrich, A. L., Jr., 1935. The thoracic sclerites of a trichopterous pupa . . . Trans. Amer. Micr. Soc., 54(1): 57-64.

Lloyd, John Thomas,- 1921. The biology of North American caddis fly larvae. Lloyd Library of Botany, Pharmacy and Materia Medica, Bulletin 21, Entomological Series, No. 1.

Ross, Herbert H., 1938. Descriptions of Nearctic caddis flies. Illinois Natural Survey Bulletin, Vol. 21, Art. 4.

Snodgrass, R. E., 1933. Morphology of the insect abdomen. Part II. The genital ducts and the ovipositor. Smithsonian Miscellaneous Collection, 89(8): 1-148.

—, 1935. Principles of insect morphology. McGraw-Hill Book Co., ix + 667 p.

Stitz, H., -1904. Zur Kenntniss des Genitalapparats der Trichopteren. Zool. Jahrb. Ant., xx, pp. 277-314.

Vosseler, J.,-- 1890. Stinkdrusen der Forficuliden. Arch. Mikr. Anat., xxvi, pp. 565-578.

INDEX—VOLUME 14

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

INDEX—VOLUME 14 (Con't)

REPRINT PRICES

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

Pages	1-2	3-4	5-8	9-12	13-16	17-20	21-24	25-28
50 copies	$1.10	$1.40	$3.85	$5.25	$7.45	$ 9.65	$11.85	$14.05
100 copies	1.40	1.65	4.15	5.80	8.00	10.20	12.40	14.60
200 copies	1.65	2.20	4.95	7.15	9.35	11.55	13.75	15.95
100 Add'n'l	0.55	1.10	2.20	3.30	4.40	5.50	6.60	7.70

Tables—for setting up—$1.25 per page extra.

Covers, per 100—$2.50

Fifty copies of reprints are free to the authors provided at least 50 copies are purchased. Reprints should be ordered in lots of 50 or multiples thereof.

Postage or express charges on carriage of reprints are extra

PRICE OF BACK VOLUMES

Volume 1 .... $2.00

Volumes 2 to 7 inclusive 1.00

Volumes 8 to date 1.50

Subscriptions for back volumes or numbers should be sent to the Secretary-Treasurer, Entomology Department, Kansas State College, Manhattan, Kansas.

CONTENTS OF THIS NUMBER

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

A quarterly journal published in January, April, July and October devoted to Entomology in the Western Mississippi Basin and the proceedings of the Kansas Entomological Society.

Manuscripts for publication may be sent to any of the publication committee.

The Kansas Entomological Society does not make exchanges since the Society does not maintain a library.

Subscription to the Journal must be paid in advance. The subscription rate is so low that second notices are not ordinarily sent out.

Payment of Canadian or other foreign subscriptions and bills must be made by international Postal Money Order or by a draft on a New York bank and payable in U. S. A. dollars.

Subscribers are urged to give us their full cooperation in these matters.

Subscriptions should be sent to the Secretary-Treasurer, Entomology Department, Kansas State College, Manhattan, Kansas.

Subscriptions in the U. S. A.,	**$1.50 per year**	**Single Copy**
Canadian or foreign subscriptions,	**1.75 per year**	**60 cents**

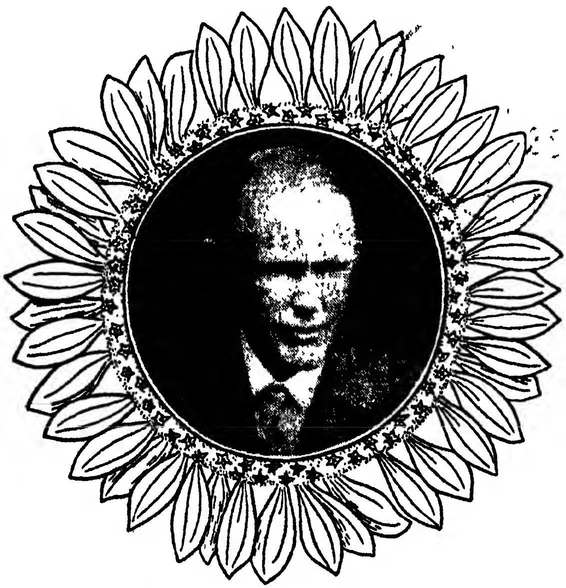
Vol 14, No. 4, October, 1941

VOL. 15 JANUARY, 1942 NO. :

Journal

OF THE

Kansas Entomological Society



JAMES WALKER McCOLLOCH
1889-1929

Entered as second-class matter June 7, 1939 at the Post Office at Manhattan, Kansas, under the Act of August 24, 1912

Kansas Entomological Society

Volume 15 | January, 1942 | Number 1

INSECTICIDAL VALUE OF CERTAIN DUSTS FOR THE PROTECTION OF STORED GRAIN

R. T. COTTON, GEO. B. WAGNER, and T. F. WINBURN,
U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine

Primitive agriculturists employed many curious devices for protecting stored grain from the depredations of insects. The use of a protective covering of dust, wood ashes, or similar finely divided material, or the mixing of the material with grain to prevent insect damage, is an ancient practice that has never been abandoned.

Recent attempts have been made in this country to popularize the use of a foreign product, consisting of pure quartz sand ground to a fine powder, for preserving stored wheat from insect attack. When mixed with grain at the rate of 1 per cent by weight, it is reported to cause the death of all grain-infesting insects in a few days. According to Germar (1936) the dust causes the death of insects by depriving them of moisture. The dust is not hygroscopic, but it adheres tightly to the insect and by capillary action conducts the body moisture to the air, which takes up this moisture. The dust therefore acts merely as a conductor of moisture, and the dryness of the surrounding air is an important factor. Kunike (1936), however, discounts the rather glowing reports of the insecticidal action of this product by pointing out that various German authorities tested it with inadequate results and that Germar did not prove its efficiency with large lots of grain.

To mix powdered sand with grain at the rate of 600 pounds per 1,000 bushels and then remove the sand would seem to make the treatment impractical from a purely economic viewpoint, since other treatments would be much cheaper. It was felt desirable, however, to determine the efficiency of the dust as an insecticide and its effect on the grain.

Five 1-kilogram samples of wheat with a moisture content of 16 per cent were placed in glass jars. Four of the samples were treated with the finely ground sand at the rate of 1 per cent by weight, and into each jar were introduced adults of the rice weevil, lesser grain borer, and cadelle, and adults and eggs of the flour beetle. The jars were set aside at room temperature and humidity for 84 days, after which they were examined. As shown in table 1, the insects bred in the untreated grain with greater freedom than in the treated grain, but the sand did not prevent them from breeding in large numbers.

Table 1.—Development of insects in various wheat samples following treatment with finely ground sand at the rate of 1 per cent by weight.

Species and Stage	No. of Insects Introduced into each Sample	Number of Insects Found After 84 Days									
		Sample 1		Sample 2		Sample 3		Sample 4		Check	
		Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
Rice weevil											
adults	20	1,640	120	2,500	96	1,390	106	1,325	150	5,400	200
Lesser gr. borer											
adults	20	62	17	40	10	32	12	52	13	36	14
Cadelle											
Adults	8	0	8	0	8	0	8	0	8	3	5
Larvae	-	34	0	40	5	13	8	34	8	50	11
Flour beetle											
Adults	20	165	32	110	39	81	9	105	24	48	10
Larvae	-	6	-	9	-	7	-	0	-	16	-
Eggs	20	-	-	-	-	-	-	-	-	-	-

Some of the wheat that had been treated with the dust at the rate of 1 per cent by weight and cleaned by the process ordinarily used in flour mills was ground into flour. Commercial cereal chemists examined this flour and found that the treatment had produced no deleterious effect.

Similar tests were conducted with an activated pyrophyllite (325-mesh pyrophyllite with the thinnest possible coating of aluminum fluoride) of domestic origin. The chemical analysis of the material as given by the manufacturer is as follows: SiO_2, 75.4 per cent; Al_2O_3, 20.4 per cent; Fe_2O_3, 0.3 per cent; K_2O, CaO, and Na_2O, 0.4 per cent, and H_2O, 3.5 per cent.

Eighteen 1-kilogram samples of wheat having a 16-per cent moisture content were placed in ½-gallon glass jars and each was infested with adults of the rice weevil and cadelle as well as adults and eggs of the flour beetle. Four samples were treated with the dust at the rate of 1 pound per bushel of grain, or 1.66 per cent by weight, and four at twice that dosage. Two weeks later four of the remaining samples were treated at the rate of 1 pound per bushel and four at 2 pounds per bushel. The remaining two samples were left untreated. Approximately 2 months later all samples were examined and a record was made of the living and dead insects found. From the data in table 2 it may be seen that the pyrophyllite also exerted a slight inhibiting effect upon the development of some of the insects, although this effect was not sufficient to be of economic value.

The results obtained with the finely ground sand and the pyrophyllite suggested the probability that the moisture content of the wheat had considerable influence on the effectiveness of the dust and

that doubtless the many conflicting reports of the effectiveness of various dusts in protecting stored grain were due to variation in the moisture content of the grain used by the investigators. It has long been known that grain low in moisture content is unfavorable for

Table 2—Development of insects in wheat treated with pyrophyllite.

Species and Stage	Number of Insects Introduced on each Sample	Number of Insects Found After Approximately 2 months					
		1.66 Per Cent Dosage		3.33 Per Cent Dosage		Check	
		Live	Dead	Live	Dead	Live	Dead
Samples Treated Immediately[1]							
Rice weevil adults	20	322	27	123	36	694	27
Cadelle							
Adults	8	0	8	0	8	4	4
Larvae	-	11	1	63	0	222	3
Flour beetle							
Adults	20	11	13	6	16	11	4
Larvae	-	38	-	60	-	4	-
Eggs	20	-	-	-	-	-	-
Samples Treated After 2 Weeks[2]							
Rice weevil adults	20	422	57	209	99	263	21
Cadelle							
Adults	8	0	8	0	8	3	5
Larvae	-	69	0	44	0	231	1
Flour beetle							
Adults	20	7	12	3	17	8	4
Larvae	-	44	-	57	-	3	-
Eggs	20	-	-	-	-	-	-

[1]Developmental period for 1.66% dosage 68 days, 3.33% dosage 57 days, and check 68 days.

[2]Developmental period for 1.66% dosage 54 days, 3.33% dosage 42 days, and check 57 days.

insect development, and with the use of small samples their natural desiccation under normal laboratory conditions would tend to make them unfavorable to insects, regardless of whether or not they were treated. Claus (1939) recently observed that the successful eradication of the granary weevil from grain by treatment with finely ground sand is not possible, at least in damp coastal districts. Undoubtedly the grain in such regions has a high moisture content.

To determine the validity of this theory, tests were conducted with a number of common dusts, most of which have been recommended at one time or another for the protection of stored grain from insect attack. The materials tested, together with the proportion in which they were mixed with wheat, are listed in table 3.

Samples of 350 and 1,000 grams containing wheat with moisture contents of 10, 12, and 16 per cent were treated with each of the materials, and samples were left untreated as checks. The samples were infested with rice weevil and flour beetle adults. They were then placed in tightly closed mason jars and set aside for incubation. A record of the insects found is given in Table 3.

Table 3.—Efficiency of various dusts in protecting stored wheat from insect attack.

Dust and Dosage	Moisture Content of Wheat, Per Cent	Size of Sample, Grams[1]	No of Insects Found at Time of Examination[2] Rice Weevil Adults Live	Rice Weevil Adults Dead	Flour Beetle Adults Live	Flour Beetle Adults Dead	Flour Beetle Larvae, Live
Borax 1%	10	350	0	10	0	10	0
		1,000	0	20	0	20	0
	12	350	0	10	0	10	0
		1,000	0	20	0	20	0
	16	350	0	39	0	10	0
		1,000	0	92	0	20	0
Soybean flour 1%	10	350	6	11	104	5	93
		1,000	19	21	185	7	124
	12	350	2	10	81	7	47
		1,000	11	24	174	18	95
	16	350	2,684	68	96	11	89
		1,000	5,726	127	196	24	94
Soybean flour 2%	10	350	10	14	90	4	68
		1,000	27	28	142	8	94
	12	350	6	12	49	8	32
		1,000	14	28	109	16	68
	16	350	3,841	94	114	18	85
		1,000	5,841	142	237	43	103
Sulfur 1%	10	350	4	11	17	10	2
		1,000	14	21	28	16	14
	12	350	0	10	0	10	0
		1,000	8	24	5	18	0
	16	350	2,643	167	87	18	66
		1,000	4,895	186	184	47	42
Sulfur 2%	10	350	0	10	1	9	11
		1,000	5	24	6	18	3
	12	350	2	16	0	10	0
		1,000	19	38	4	27	0
	16	350	2,416	78	94	17	72
		1,000	4,432	147	162	42	25
Lime 1%	10	350	0	10	0	10	0
		1,000	0	28	4	16	0
	12	350	0	10	1	9	0
		1,000	7	36	1	19	0
	16	350	475	116	3	34	0
		1,000	842	187	31	45	2

Dust and Dosage	Moisture Content of Wheat, Per Cent	Size of Sample, Grams[1]	No. of Insects Found at Time of Examination[2] Rice Weevil Adults Live	Rice Weevil Adults Dead	Flour Beetle Adults Live	Flour Beetle Adults Dead	Flour Beetle Larvae, Live
Lime 2%	10	350	0	10	0	10	0
		1,000	0	20	3	17	2
	12	350	0	10	0	10	0
		1,000	0	20	0	20	0
	16	350	68	179	0	10	0
		1,000	25	164	0	20	0
Wood ashes 1%	10	350	1	9	46	11	6
		1,000	18	13	92	10	36
	12	350	2	17	17	10	12
		1,000	18	24	103	18	67
	16	350	482	25	106	14	79
		1,000	3,542	121	208	36	92
Wood ashes 2%	10	350	1	9	26	9	2
		1,000	14	16	64	11	18
	12	350	3	18	10	8	2
		1,000	0	20	98	14	42
	16	350	164	27	79	9	68
		1,000	3,731	97	126	32	86
Check	10	350	17	11	15	2	7
		1,000	49	22	97	6	43
	12	350	29	14	8	2	0
		1,000	51	14	74	11	11
	16	350	3,672	125	85	14	78
		1,000	5,678	214	82	34	97

[1]350-gram samples each infested with 10 adult rice weevils and to adult flour beetles and 1,000-gram samples with 20 of each insect species.

[2]Samples of wheat with a 10-per cent-moisture content were examined after 87 days and the other samples after 112 days.

Wood ashes and soybean flour had no appreciable effect in preventing insect development. Sulfur dust was slightly affective with 10- and 12-per cent-moisture wheat, but in the 16-per cent-moisture wheat treated with this dust insect development was almost as rapid as in untreated wheat of the same moisture content. Lime showed good protection for 10- and 12-per cent-moisture wheat and some protection for 16-per cent-moisture wheat, although not adequate for practical purposes.

With the exception of the wheat having a 16-per cent-moisture content, there was no increase in infestation in the samples treated with borax, and no life was apparent in any of the samples at the time of examination. It would seem therefore that treatment with 1 per cent by weight of borax is adequate protection for stored grain against insect attack. Unfortunately its use cannot be recommended,

since it is absorbed by the grain.

Insect development varied among the different untreated samples of wheat. Development was exceedingly slow in that of 10- and 12-per cent-moisture content but rapid in wheat of 16-per cent-moisture content.

A number of poisonous dusts have been recommended from time to time for the protection of stored seeds from insect attack and there is little doubt that many of them are highly effective. They are, however, of value only in protecting grain that is intended for seeding purposes, and it is doubtful whether they should even be recommended for this purpose owing to the chance that treated grain may accidently be used for food.

According to the results of these studies it does not seem likely that adequate protection from insects can be obtained for stored grain by admixture with dusts other than those which are poisonous or which exert some deleterious effect on the grain.

LITERATURE CITED

Claus, Arnold 1939 Über weitere Prufungen des Praparates Naaki als Kornkaferbekampfungsmittel im Jahre 1938. Ztschr. f Angew Ent 26(1): 165 170

Germar, B. 1936. Versuche zur Bekampfung des Kornkafers mit Staubmitteln Ztschr f Angew Ent. 22(4): [603]-630. 9 figs.

Kunike, G. 1936. Zur Veroffentlichung von B Germar Versuche zur Bekampfung des Kornkafers mit Staubmitteln Eine Stellungnahme Ztschr f. Agnew Ent 23 (1) 174-176.

DISTRIBUTIONAL RECORD FOR NOTONECTA HOFFMANNI HUNGERFORD 1925

In the study of some **Notonecta** taken by the Kansas Biological Survey party during the summer trip of 1936, the following distributional record was found worthy of note.

Five specimens, three males and two females, bear the label Silver City, New Mexico, July 22, 1936, collected by R. H. Beamer and M. B. Jackson. These specimens were typical of **Notonecta hoffmanni** Hungerford in every way.

This species has previously been recorded from Lower California, western Mexico, and Arizona.

R. I. SAILER

MEGABOTHRIS ABANTIS (ROTHSCHILD): DESCRIPTION OF THE FEMALE. (SIPHONAPTERA).

NEWELL E GOOD, Associate Entomologist,
United States Public Health Service

1905. **Ceratophyllus abantis** Rothschild, Nov. Zool. 12:164-165, pl. 6, fig. 10 Described from two males, one from **Putorius longicaudatus** (now **Mustela frenata longicauda**), Canadian National Park, Alberta, and one from **Microtus drummondi,** Horse Creek, Upper Columbia Valley, British Columbia.

1933. **Megabothris abantis** (Rothschild), Jordan, Nov. Zool. **39**:77.

Female: head:—The upper or frontal row contains 5, occasionally 4 or 6, bristles and the lower or ocular row contains 3, rarely 2, long bristles. On the occiput there are 3 bristles in addition to those of the marginal row. Along the rear margin of the antennal groove there is a single row of setae. The 5-jointed labial palpus reaches nearly to, sometimes to, the apex of the fore coxa. The maxillary palpus extends to or slightly past the base of the last joint of the labial palpus.

Thorax:—The pronotal comb consists of 19 to 21 spines, of which the lower one on each side is usually very much reduced, there being 18 or 19 normal sized spines. There is only one row of bristles on the pronotum in front of the pronotal comb. The metanotum may or may not bear one very small apical spinulet.

Abdomen:—The abdominal tergites bear apical spinulets as follows (average, minimum and maximum on each side, respectively): I=1(0—2); II=2(1—2); III=1(1—2); IV=1(0—1).

Modified segments:—There are 3 antepygidial bristles (Ap. br.), the average lengths of which are:—upper or inner=0.08 mm.; middle =0.24 mm.; lower=0.08 mm. The antepygidial stigma (Sti.) is large, measuring on an average 0.09 mm. in length (= height), by 0.05 mm. in width. The upper margin of the pygidium (Pyg.) is very slightly concave. The stylet (Sty.) is short, thick on the basal half and with the margins convex. It averages 0.053 mm. in length by 0.026 mm. in greatest diameter. It bears one long terminal bristle about 3 times as long as the stylet, and 2 or 3 lateral bristles. The posterior margin of the 7th sternite is without a sinus. It is produced backward into a short, broad lobe starting slightly above the base of the posterior margin. The rear margin of this lobe may be either regularly rounded or somewhat irregular. The 7th sternite bears a principal row of 4 to 6 bristles, in front of which there are from 3 to 9 smaller bristles. The 8th sternite is fairly long, but narrow. The posterior margin of the 8th tergite is irregularly rounded with a small lobe on its upper part. The 8th tergite bears 2 long bristles below the stigma, and from 13 to 19 bristles of various sizes nearer the lower margin. The 10th sternite is angulate, the

postero-ventral margin armed with a large number of spines and bristles. The head of the receptaculum seminis (R.s.) is cylindrical, measuring on an average 0.115 mm. in length and 0.062 mm. in width, and is rather heavily chitinized. The tail of the receptaculum seminus is bent at an angle of from 90° to 120° with respect to its head, and is moderately chitinized toward the rounded apex. It is parallel sided and averages 0.93 mm. in length by 0.028 mm. in diameter. The duct of the receptaculum seminis (D.r.s.) (in contrast to Jordan, 1929, Nov. Zool. 35:33)[1] is not conspicuous, being small and lightly chitinized. The bursa copulatrix is fringed anteriorly with ramnifying ducts but is not heavily chitinized at any point.

Length:—2.57 (1.9—3.4) mm.

Allotype female collected from **Citellus columbianus**, Deer Lodge County, Montana, on Georgetown Lake shore, elevation 5,700 feet, August 10, 1928, by Montana State Plague Survey field crew, and deposited in the collection of the United States Public Health Service, Plague Suppressive Measures Laboratory, San Francisco, California. The above collection contains the following additional specimens of this species, all collected by the field crews of this laboratory and of states cooperating in Plague survey work.

Oregon: Grant County, from **Citellus beldingi oregonus**, 1 female; from **Citellus columbianus**, 1 male; Wallowa County, from **Citellus columbianus**, 1 female.

Idaho: Latah County, from **Citellus columbianus**, 1 female; Caribou County, from **Citellus armatus**, 1 female.

Montana: Flathead County, from **Sciurus hudsonicus richardsoni**, 1 female; Granite County, from **Citellus columbianus**, 1 male; Beaverhead County, from **Citellus richardsoni elegans**, 1 female; from **Citellus columbianus**, 1 male; from **Eutamias** sp., 1 male; Jefferson County, from **Citellus columbianus**, 1 female; Madison County, from **Citellus richardsoni elegans**, 1 female; Meagher

[1]Wagner 1936 (Ziets.f Parasit 8:656, text-fig 3), describes **M. adverus**; from a single female with a very lightly chitinized duct of the receptaculum seminis, as a new species, separating it from **M. abantis** largely on the basis ot Jordan's statement. The writer has examined 33 females of **M. abantis** from 6 western states, several of them in the same lots as males of this species, and finds this duct to be inconspicuous in all of them. On the other hand, this duct in **M. lucifer** (Roths.) 1905, is large, heavily chitinized and conspicuous Since the female of **M. lucifer**, being described by Rothschild, was available to Jordan, while that of **M. abantis** was then undescribed, it is quite possible that Jordan intended to write "**C. lucifer**" instead of "**S. abantis**" (sic). If this is the case, Wagner's **M. adversus** has been created due to an error. In any case, the writer can find nothing in Wagner's description or figure which separates **adversus** from **abantis** and therefore considers it to be very probably a synonym of **abantis**. He has not seen the monotype of **adversus**, however, and so cannot make a final decision on the matter.

County, from **Mustela arizonensis**, 4 males and 2 females; Park County, from **Citellus richardsonii**, 2 females; from **Citellus armatus**, 1 female; from **Marmota flaviventris**, 1 male; from **Ochotona princeps**, 1 female; Fergus County, from **Rattus norvegicus**, 1 male; Yellowstone National Park (Mont.), from **Glaucomys sabrinus**, 1 female;

Wyoming: Yellowstone National Park, from **Microtus pennsylvanicus**, 3 females, and from **Zapus princeps**, 1 male, 2 females; Park County, from **Sylvilagus auduboni**, 1 male, and from **Citellus armatus**, 1 female; Teton County, from **Citellus armatus**, 2 males, 1 female; Lincoln County, from **Citellus armatus**, 1 female, from **Peromyscus** sp., 1 female, and from **Mustela arizonensis**, 1 female; Uinta County, from **Mustela** sp., 1 male, 1 female;

Utah: Uintah County, from **Citellus lateralis**, 1 male and from **Mustela arizonensis**, 1 female; Wasatch County, from **Mustela arizonensis**, 1 male;

Colorado: Routt County, from **Eutamias minimus**, 1 female; Grand County, from **Citellus richordsonii elegans**, 1 male.

The following additional specimens of this species, from the collection of the Rocky Mountain Laboratory, U. S. Public Health Service, have been examined by the writer:—

Oregon: Morrow County, from **Citellus columbianus**, 1 male;

Montana: Ravalli County, from **Sciurus hudsonicus**, 2 males; from **Citellus columbianus**, 1 female; Glacier National Park, from Coyote, 1 female; Madison County, from **Citellus** sp., 1 female, from **Mustela** sp., 1 female.

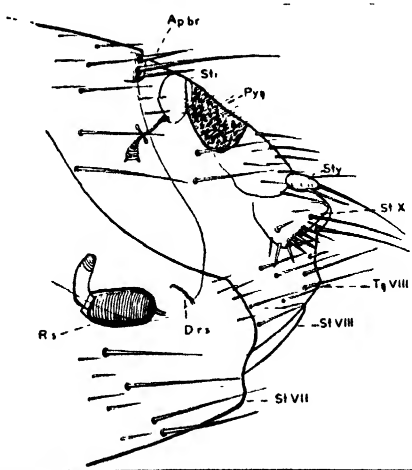


Figure 1. **Megabothris abantis** (Roths.), female, modified segments. X87
Abbreviations.--Ap. br., antepygidial bristles; D r.s., duct of the receptaculum seminis; Pyg., pygidium; R.s., receptaculum seminis; St., sternite; Sti., stigma; Sty., stylet; Tg., tergite.

SOME NEW SPECIES OF SYRPHIDAE

FRANK M HULL, University of Mississippi

In this paper I present the description of three new Syrphid flies from the neotropical region. Types are in the author's collection.

Rhysops pollinosa n. sp.

Related distantly to **Rhysops (Melanostoma) lineata** Fluke; **pollinosa** is characterized by the four facial grooves, the linear spots, the smoky wing tips.

Female. Length 9 mm. **Head:** front and vertex subopaque black, the former broadly divided transversely by yellowish-brown pollen; the face is pale greyish-yellow, almost white pubescent and with similar pile. There is a broad, shining, brownish-black middle stripe and a submedial, incomplete stripe partly bisecting the facial pubescence. There are four transverse facial grooves. The pile of front and vertex is black; the cheeks are bluish-black, the antennae missing. **Thorax:** mesonotum and scutellum bright brassy-black with obscure, brownish pollinose vittae. Viewed posteriorly the anterior half has a moderately separated stripe of light brownish-yellow pollen; elsewhere the pollen is dark brown, except on the lateral margins; scutellar margin with a pair of slender, pale bristles. **Abdomen:** elongate, the first segment shining black, the second shining blue-black with an obscure, diffuse, brownish-orange, elongate, sublateral spot along the outer portion of the segment; they are thus very widely separated and are equidistant from base and apex of segment. Third segment with quite similar, slightly smaller spots that begin at the base. Fourth segment, with smaller and similar basal spots. **Legs:** everywhere light orange-brown except the middle three anterior tarsal joints, last three middle and posterior tarsal joints, the broad middle of the hind tibiae, the apical half of the hind femora except its narrow apex, all of which are black. **Wings:** pale brown, darker near the apex; stigma dark yellowish-brown.

Holotype: one female, Sao Paulo, Brazil, Nov., 1940. (J. Lane, collector).

Rhysops lachrymellea

Related to **Rhysops (Melanostama) lanei** Fluke, but the abdominal spots reach widely over the margin, especially on the second segment.

Male. 7 mm. long. **Head:** vertical and facial pile pale, the latter broadly whitish pubescent along sides, leaving the anterior part of the cheeks and a broad middle stripe shining bare. This stripe is metallic black, violet margined; down this stripe for a short distance, as far as the single transverse groove, runs a stripe of pubescence; moreover,

dividing the lateral pubescent portion of the face is a stripe which by its shining, brassy color, obscures that part of the pubescence. Antennae elongate, light brownish-orange, the third joint two and one-half times as long as wide, and black at extreme apex and all along the dorsal edge. **Thorax:** mesonotum brilliant, metallic greenish-white There are a pair of broad stripes of pale yellowish pollen that are narrowly separated by dark brown pollen; lying outside of these are a pair of wider, dark brown pollen stripes. The lateral third of the mesonotum anteriorly is pale pollinose. Both thoracic pile and scutellar pile is pale brassy. The scutellum is bright, pale, greenish-brassy in ground color; its apex has a pair of slender bristles, black on their distal half. **Abdomen:** first segment metallic black; remaining segments shining sepia-black with spots of pale brownish-yellow as follows: large lateral spots on second segment separated by a third of segment's width and covering entire lateral margin but attentuated posteriorly; the pair of spots on third segment are larger, more narrowly separated, are oblong and somewhat oblique spots, that posteriorly diverge and turn out to the lateral margin in the middle of the segment; the basal corners of this segment are dark; fourth segment with quite similar spots which however, do not reach the lateral margin. **Legs:** first four legs light orange-brown except for the dark brown middle three tarsal joints of anterior pair and apex of their first joint. Hind legs blackish-brown, the base of hind femora narrowly and the hind basi tarsi orange-brown. Wings hyaline; stigma yellow.

Holotype: one male, Sao Paulo, Brazil, Oct., 1940. J. Lane, collector.

Meromacrus ceres

Related to **brunneus** Hull, but distinguished by the presence of the yellow, median thoracic stripe.

Male. Length 13 mm. **Head:** front and facial pile pale yellow, that of vertex black, of occiput yellow. Front, cheeks and a broad facial stripe shining black. The antennae are dark brown, the first joint black, the third longer than wide, rounded but subtruncate dorsoapically; arista pale. **Thorax:** mesonotum dull brownish-black with brownish-yellow tomentum as follows: a narrow but quite evident middle stripe which before the scutellum becomes a large, hollow-sided, yellow triangle; a narrow, transverse, sutural stripe evanescent at both medial and lateral ends, hence not continuous with the posterior end of the well developed, bright yellow, diagonal stripe that borders the humeri; the prescutellar stripe continues out toward the border of the post calli. Remainder of mesonotal, and all of scutellar pile save for a few scattered hairs and its yellow marginal pile, shining reddish-brown. Ground color of scutellum brown,

becoming darker at base and lighter toward apex. **Abdomen:** brownish-black covered with appressed pile which is except for tomentous markings hereafter described black on the third segment and chiefly shining reddish-brown over the broad second segment and over the fourth segment. The posterior middle of the second segment and post margin of the fourth segment has some black setaceous pile. Only the first segment has a conspicious transverse stripe of tomentum which however is evanescent some distance from the lateral margin. However on the base of the third segment there is a quite narrow, inconspicuous fringe of flat-lying yellow pile, narrow and evanescent, in the middle. **Legs:** the femora are shining black, the anterior four somewhat more brownish-black; all of the tibiae dark brown. The middle and hind tarsi are light brown on their dorsal surfaces, the anterior pair more blackish. All dorsal tarsal pile black. First four femora and tibiae and hind tibia wholly pale brassy pilose. The front and middle femora and their coxae and metasterum and hind coxae have long crinkly tufts of yellow-white pile. The hind femoral pile is pale upon its base and laterally, but is widely black distally both above and below. **Wings:** with anterior border and base dark brown, the costal cell dark brown; sinus of loop of third vein clear.

Holotype: one male. Received some years ago in miscellaneous material from Brazil.

BUTTERFLY RECORDS FOR KANSAS

DON B. STALLINGS and DR J. R. TURNER, Caldwell, Kansas

Thorybes confusis (Bell) Mr. William D. Field in his "Manual of the Butterflies and Skippers of Kansas" suggests that this species should be found in Kansas. We are pleased to record that a single perfect female of this species was taken in Sumner County, Kansas in June, 1941. Determined by H. A. Freeman.

Achlyodes thraso (Hubner) This species has been previously recorded from Kansas on the strength of a specimen taken in Riley County in July of 1921. We wish to record a second specimen taken in Sumner County during October of 1941.

Atrytone arogos iowa (Scudder) A single speciman of this species was taken in Sumner County, during June, 1941. Although it has been taken a number of times in other parts of the state, this is the first record for the South-Central area.

THE LIFE HISTORY AND HABITS OF THE RING-LEGGED EARWIG, EUBORELLIA ANNULIPES (LUCUS) (Order Dermaptera)

EDWARD C. KLOSTERMEYER, Lincoln, Nebraska

The ring-legged earwig, **Euborellia annulipes** (Lucas),[1] was first recorded in the United States by Rhen and Hebard (6) in 1902. Since that time it has been reported from numerous states including for the most part, south-eastern, south-central, mid-western and south-western states. In Canada it is known to occur in British Columbia. It has also been reported from Central and South America, several European countries, India, China, Japan, and a number of the islands of the Pacific and South Pacific regions.

In the early part of May, 1939, I found an infestation of **E. annulipes** in the basement of a feed building on the University of Nebraska poultry farm at Lincoln where the earwigs were observed to be feeding on grain and to some extent on stored grain insects. Apparently this is the first authentic record of its occurrence in Nebraska. In spite of the practically cosmopolitan distribution of this insect, there is little published information concerning its biology. A study of the life history and habits of this species was made by me at the University of Nebraska during 1939 and 1940 while a major student in the Department of Entomology.

ECONOMIC IMPORTANCE

The ring-legged earwig is of considerable economic importance in some areas. It may be destructive or, because of predatroy tendancies, it may be beneficial. It has been reported as a pest of Irish and sweet potatoes in storage (5), and as a nuisance in meat packing plants. Professor R. C. Smith of Kansas State College, recently told me that this earwig is a common pest of flour mills in Kansas. In tropical regions it is predaceous on a number of insect pests, preying upon the sugar cane leafhopper (**Perkinsiella saccharicida**) in Hawaii (7), on a weevil pest (**Cosmopolites sordidus**) of bananas in Jamaica (4), and on the larvae of an owlet moth (**Sesamia inferens**), a pest of sugar-cane in Japan (8).

REARING METHODS

The earwigs were reared in two kinds of cages. One was a plaster of Paris block with cells one-quarter inch deep cut into it and the whole surface covered with a glass plate, while the other

[1]I am indebted to Mr. A. B. Gurney of the U. S. D. A Bureau of Entomology and Plant Quarantine for identification of the species and for information on distribution and economic importance, to Dr. H. D Tate, Prof M H. Swenk, and other members of the University of Nebraska Department of Entomology for suggestions and criticisms on this paper.

was a one-fourth pint ice cream container. In the first type, the high humidity necessary for the development of the earwigs was maintained by placing the entire plaster of Paris block in a pan of water for a few minutes every day. Since the earwigs are nocturnal, the glass plate was covered with a sheet of paper to exclude light. These cages were satisfactory except that conditions were also ideal for the rapid growth of fungi in them which necessitated frequent cleaning.

The bottoms of the ice cream containers were covered with one-quarter inch layer of plaster of Paris which was kept moist to maintain a high humidity. The earwigs could not climb the waxed, sloping sides of the container and, except for some of the larger ones, could not chew their way out of it. In this type of cage fungous growth was at a minimum. A convenient surface for records and labels was provided by the cardboard covers of the containers. The food supply consisted largely of wheat.

The earwigs were reared in a laboratory where the temperatures fluctuated from approximately 65 degrees F. to 85 degrees F. The variation between the life history records of the fall reared earwigs as compared to the winter and spring individuals probably is due to differences in temperatures existing at these times.

DESCRIPTION

The ring-legged earwig has been well described by Blatchley (1). It is 12 to 15 mm. long, dark brown to black with the under surface yellowish brown. The legs are yellowish with the femora and tibia ringed with fuscous. The antennae are 16 jointed and black in color except for the third and usually the fourth segment from the apex which are white. The forceps of the male are contiguous at the base, strongly incurved with the right one more so and crossing over the left at its apex. The forceps of the female are only slightly and equally curved at the tips. The male has ten abdominal tergites, whereas the female has but eight.

The nymphs resemble the adults except in size. The earlier instars are more greyish than black and the fuscous markings on the legs are less prominent. The abdomen is ten segmented and the forceps are the same in both sexes. The most striking difference between the five different instars is the increase in the number of antennal segments. The antennae are 8 jointed in the first instar, 11 jointed in the second, 13 jointed in the third, 14 jointed in the fourth, and 16 jointed in the fifth. The antennal segments are black with the base and apex of each segment pale and in the first and second instars the penultimate segment is completely white while in the third, fourth, and fifth instars the third segment from the apex is white.

The eggs are approximately 1 mm. long and 0.8 mm in diameter,

ovate, creamy white in color, covered with a transparent shell, and later become brown in color and kidney shaped.

LIFE HISTORY AND HABITS

Adults. In general, the habits of **Euborellia annulipes** are similar to those of cockroaches. It is nocturnal, negatively phototropic, and an omnivorous feeder. Under natural conditions, it lives under litter of various types, under rocks, and similar places where shallow holes are excavated in the soil as a nest for the deposition of the eggs and the rearing of the young. This earwig probably does not overwinter out-of-doors in the northern part of its range.

Copulation may occur a day or so after the final nymphal moult. At the time of mating, the male, upon sensing the presence of a female, backs toward her. The tip of his abdomen is then manipulated in such a way as to make contact with the copulatory organs on the ventral surface of the abdomen of the female. Occasionally the male completely turns over in this effort. They remain in copulation for only a few minutes. Unlike **Forficularia auricularia** the forceps are not used in mating (3).

Although these earwigs mate frequently, only one union is necessary for the production of several clutches of eggs. Females have been observed to produce as many as six clutches of eggs from a single mating. In the tests described in this report, there was an average preoviposition period of 10.77 days (Table 1). The maximum number of eggs per female was 74, the minimum 22 and the average 47. DeGeer, in 1773, was the first to record the fact that female earwigs brood over their eggs like a hen and this observation has since been confirmed by other authors. The female of the ring-legged earwig also has this peculiar habit. Eggs are deposited in a hollowed-out cell in the earth, the oviposition period usually extending over a period of two or three days. The female remains over the eggs, guarding them carefully and occasionally cleaning them with her mouth. If the eggs are scattered about, she picks them up and carries them one by one in her mandibles to a single pile where she continues to guard them. She can effectively use her forceps for defense and will nip the fingers sharply if handled. It was observed several times that the female, if unduly disturbed, would eat her eggs, sometimes destroying the whole clutch.

Eggs. It has been stated by observers of other species of earwigs that eggs taken from the female would not hatch (2, 4). To check this observation, a clutch of newly laid eggs was divided into two groups. Twenty-five eggs were put into one cell of a plaster of Paris block and twenty-seven eggs were left with the mother in another cell in the same block. Of the twenty-five eggs in the first group, five hatched in seventeen days while the remaining twenty

eggs were destroyed by mold and did not hatch. All of the twenty-seven eggs left with the mother hatched on the same day as the motherless eggs. Since the eggs will hatch if kept under the proper conditions and protected from fungous growth, it seems evident that the female's association with the eggs following their deposition is in a protective capacity.

Eggs kept in a dry atmosphere showed evidence of severe dessication within three days and failed to hatch. When kept in a humid atmosphere, the eggs increased both in size and weight and changed considerably in shape. The average length of 324 eggs at the time of deposition was 0.845 mm. and the diameter 0.637 mm. Newly laid eggs were ovate in shape and creamy white in color, but as they developed they became kidney-shaped, grey or brownish in color and the developing embryo could be seen plainly through the transparent eggshell. One day before hatching, the average length of 153 eggs was found to be 1.02 mm. and the diameter 0.8 mm. which was an incrasc of 0.175 mm. in length and 0.163 mm. in diameter. When first laid, the eggs averaged 0.367 mg. in weight and one day before hatching, the average was 0.812 mg. This increase of 0.445 mg. in weight probably was due to the absorption of water by the egg. The incubation period averaged 14.32 day in length. The hatching of a clutch of eggs usually covered a period of two or three days, although some clutches hatched completely in a single day.

Nymphs. The first meal of the newly hatched nymphs was its empty eggshell and later the exuvia often was eaten at the time of moulting. They readily eat wheat and other grains, usually first attacking the germ but finally consuming the entire kernel. At the time of moulting, the nymph emerged from its old skin through a split on the Y-shaped epicranial suture and along the median groove of the dorsal surface of the thorax.

Evidence indicates that a high humidity is essential for nymphal development. Four nymphs kept in a dry cage died in three days. Three successive generations of **Euborellia annulipes** were reared, one in the fall, one in the winter, and another in the spring. The spring-reared earwigs developed more rapidly than did the earwigs reared in the fall and winter, probably because of the higher temperature conditions prevailing then. The average nymphal period of spring-reared earwigs (March 20 to June 30) was 56.44 days with a maximum of 89 days and a minimum of 45 days. The average for 32 individuals reared in the fall (September 18 to February 8) was 83.23 days, the maximum 176 days and the minimum 57 days. The average for 15 individuals reared in the winter (February 8 to May 18) was 87.86 days, the maximum 94 days and the minimum 71 days.

Table 1.—Summary of the life cycle of **Euborellia annulipes** (Lucas).

Stage	Specimans observed	Maximum	Minimum	Average
	Number	Days	Days	Days
Preoviposition period	22	22	5	10.77
Egg	1231	19	9	14.32
First instar	168	20	6	10.60
Second instar	136	25	8	13.49
Third instar	116	25	5	16.17
Fourth instar	75	75	7	20.01
Fifth instar	50	68	8	29.54
Total nymphal	56	176	45	80.71
Egg to adult	56	190	61	95.03

PROPORTION OF SEXES

Of the 56 earwigs reared to maturity, 41 of them were females and 15 were males, a proportion of nearly 4 to 1. The majority of the earwigs collected under natural conditions were females.

LONGEVITY

The ring-legged earwig is long-lived in captivity. One female which became mature on November 16, 1939 was still living on June 21, 1940, 229 days later, at which time it was destroyed. Other individuals lived more than seven months in the adult stage. One female died, apparently of natural causes, at the age of 203 days and another at the end of 206 days.

FOOD HABITS

Euborellia annulipes feeds omnivorously but appears to have a preference for an insect diet. Whole wheat was used in most of the rearing, but the earwigs also ate other grains, potatoes, meat, lettuce, and both living and dead insects. To some extent they were cannibalistic, feeding on eggs, living and injured earwigs, and evidence indicated that the female often killed and ate the male. This cannibalistic tendency may have been due, in some degree, to the vegetable diet upon which they were reared.

Insects were captured and retained by means of the forceps. In one instance, a dermestid larva was dropped into the cage of a large female earwig. She immediately grasped it in her forceps and while still holding the struggling larva, she turned her body in a half circle and proceeded to eat it. Flies and other insects were caught and eaten in much the same manner.

REGENERATION

The ring-legged earwig regenerates lost or broken appendages. Earwigs with regenerated forceps have been collected under natural conditions and several were reared. In one case of left forcep

of an earwig in the third instar was cut off near the base. At the next moult the appendage had become normal in shape but was slightly smaller than the right forcep, and following final the moult, there was scarcely any detectable difference in size between the right and left halves of the forceps.

LITERATURE CITED

1 Blatchley, W S 1920 Orthoptera of Northeastern America. P 47.
2 Bennett, C B. 1904. Earwigs, (**Anisolabis maritima** Bon). Psyche 11:47-53.
3. Edwards, W. H. 1934 Pests of Bananas in Jamaica. Entom. Circ. No. 14, Department of Science of Agriculture of Jamaica.
4. Goe, M. T. 1925. Eight Months' Study of Earwigs Entom. News 35:235.
5 Lyle, C 1930. U. S D A. Insect Pest Survey Bulletin. 10.381
———. 1932. U. S. D. A. Insect Pest Survey Bulletin. 12:346
———. 1937. U. S D A Insect Pest Survey Bulletin 17 96
6. Rhen, and Hebard, M. 1905. Proc Acad Nat Sci 1904, p. 778.
7. Swezey, O. H 1936. Biological Control of the Sugar Cane Leaf Hopper in Hawaii Bull 21, Exp Sta., Hawaiian Sugar Planters Association. p. 91.
8. Yanagihara, M. 1934. Formosan Sugar Planters Association. 12:1-3.

HOST RECORD AND DISTRIBUTIONAL NOTE FOR DERAEOCORIS RUFIVENTRIS KNIGHT 1921 (MIRIDAE)

R I. SAILER, Lawrence, Kansas*

Of the twenty-four specimens of this species found in the Francis Huntington Snow Insect Collection, eighteen were collected during the summer of 1938. This is of partciular interest for it was during this summer that Dr. R. H. Beamer and his Biological Survey Party attempted to study especially the insects associated with **Arctostaphylos** (bear berry). More important is the host record **Arctostaphylos pungens** H. B. K., found on eight specimens taken at Idyllwild, California, July 29, 1938 by R. H. Beamer.

From the remaining sixteen specimens which bore no host records the following localities are noted: Dales, Calif., June 28, 1935 (R. H. Beamer); San Jacinto Mts., Calif., July 21, 1921 (L. D. Anderson); Truckee, Calif., August 20, 1938 (R. I. Sailer); Towie, Calif., August 20, 1938 (L. W. Hepner); Canyonville, Ore., July 12, 1935 (R. H. Beamer); Jamesburg, Calif., Aug. 11, 1938 (R. H. Beamer).

It would seem likely that this species feeds on plant lice or other soft-bodied insects living on **Arctostaphylos**. As might be expected and is indicated by its specific name, this insect is largely reddish-brown, thus conforming with the reddish color of the branches and twigs of the bear berry bush.

This species had hithertofore been known from the type locality, taken June 28, San Diego County, California (E. P. Van Duzee).

*Contribution from the Department of Entomology, University of Kansas.

A REVISION OF THE GENUS CEROTAINIOPS CURRAN (DIPTERA; ASILIDAE)

A. EARL PRITCHARD, University of Minnesota

On the basis of three asilids which he collected in New Mexico, Brown (1897), described **Nusa abdominalis** and **Nusa similis**. McAtee (1919), incorrectly identified Arizona material as **abdominalis** and proposed **Nusa abdominalis atripes** for two other specimens, one from New Mexico and one from Arizona. Subsequent workers have afforded **atripes** specific rank. **Nusa** Walker was later found to be untenable for North American species (Ricardo, 1927), so that these and other species included in **Nusa** were then referred to the genus **Andrenosoma** Rondani. **Atripes** and **similis** are here shown to be synonyms of **abdominalis**.

Curran (1930), described **Cerotainiops rufiventris** as a new genus and species on a basis of two specimens from Arizona. **Rufiventris** is here shown also to be a synonym of **abdominalis**. The genus **Cerotainiops** is distinct from **Andrenosoma**, however, and is retained for **abdominalis** and two other species from the Southwest which are described as new.

Fifty-five specimens of **Cerotainiops** have been studied for this revision. These species are very fast fliers, which is probably responsible for their being poorly represented in collections. Those specimens of **abdominalis** which the writer has collected in southwestern Oklahoma were ground inhabitants which is unusual in this tribe. The flies were found under xerophytic conditions where it seemed unlikely that the larvae could occur in wood. Our knowledge of the Laphriine robberflies to date indicates that the larvae of these genera are found only in wood where they are predaceous on borers. This is particularly true of **Andrenosoma** to which **Cerotainiops** is most closely related.

For the loan of material and for the priviledge of examining types, the writer wishes to express his appreciation to Mr. Joseph Wilcox, Dr. R. H. Beamer, Dr. R. H. Painter, Dr. C. H. Curran, Dr. E. A. Chapin, Mr. C. F. W. Muesebeck, Dr. F. E. Whitehead, and to Dr. C. E. Mickel.

Cerotainiops Curran

1919. **Nusa** (in part) McAtee (not Walker), Ohio Jour. Sci., 19 (4): 244.
1930. **Cerotainiops** Curran, Amer. Mus. Nov., 415: 11.
1934. **Andrenosoma** (in part) Bromley, Ann. Ent. Soc. Amer., 27 (1): 84.

Cerotainiops is not closely related to **Cerotainia**, **Atomosia**, or other genera of **Atomosiini** as indicated by its describer. It is most

closely related to the nearly cosmopolitan genus **Andrenosoma** Rondani, particularly because of the depressed proboscis which is but slightly upturned distally, and because of the strongly flattened second palpal segment. The wing venation of **Cerotainiops** is very similar to that of **Nusa** Walker (=**Dasythrix** Loew) in that the longitudinal veins attaining the posterior margin of the wing are evanescent distally. **Cerotainiops** further differs from **Andrenosoma** in that the facial tubercle is not abrupt above; the mystax is more or less tectiform, composed of rather dense bristles below and recumbent silky hairs above; the body and legs are not as hairy; the abdomen is robust, concealing the genitalia from above; the ovipositor is not compressed, the oviduct a very short, eversible tube. The third antennal segment of **Cerotainiops** is rather short, pyriform, the first posterior cell is closed and long petiolate. The species here included form a homogeneous group differing from each other principally in chaetotaxy, pollinosity pattern, somewhat in color, and only slightly in genital characters.

Genotype.—(**Cerotainiops rufiventris** Curran)= C. **abdominalis** (Brown). Original designation.

Key to Species

1. Scutellum with a fringe of short marginal hairs; thoracic pleura largely whitish pollinose, with a large spot behind the anterior coxa and a smaller spot behind the middle coxa bare of pollen and shining (N. Mex., Tex., Okla., Kans., Ariz., Calif) ____________________**abdominalis** (Brown)
   Scutellum with one or two pairs of long marginal bristles; thoracic pleura entirely pollinose or largely bare of pollen____2
2. Thoracic pleura largely bare of pollen, shining; posterior femora blackish; hairs of proximal division of first abdominal segment black (Calif.) ___________**oma**, new species
   Thoracic pleura entirely pollinose; posterior femora largely orange, infuscated at distal end; hairs of proximal division of first abdominal segment whitish (Ariz., Calif.) _____________________________________**wilcoxi**, new species

Cerotainiops abdominalis (Brown)

1897. **Nusa abdominalis** Brown, Kans. Univ. Quart., 6 (2): 103.
1897. **Nusa similis** Brown, Kans. Univ. Quart., 6 (2): 103. New synonmy.
1919. **Nusa abdominalis atripes** McAtee, Ohio Jour. Sci., 19 (4): 247 New synonmy.
1919. **Nusa similis** McAtee, Ohio Jour. Sci., 19 (4): 248.
1930. **Cerotainiops rufiventris** Curran, Amer. Mus. Nov., 415: 11. New synonmy.

1934. **Andrenosoma abdominalis** Bromley, Ann. Ent. Soc. Amer., 27: 84, 103.
1934. **Andrenosoma similis** Bromley, Ann. Ent. Soc. Amer., 27: 84.
1934. **Andrenosoma atripes** Bromley, Ann. Ent. Soc. Amer., 27: 84.

Types.—Of **abdominalis**, one female, Cuba, Bernalillo Co., New Mexico (Barnum Brown), which has apparently been lost; of **similis**, two females, Cuba, Bernalillo, Co., New Mexico (Barnum Brown), which has apparently been lost; of **atripes**, type, female, Mesilla, New Mexico, July 12, 1897 (Cockerell), in the United States National Museum; of **rufiventris**, holotpye, female, Coyote Mts., Arizona, August 4-7, 1916, in the American Museum of Natural History. Dr. Barnum Brown informed the author that the types of his species were deposited in Dr. Williston's collection. Dr. R. H. Beamer advised the author that these specimens were not recorded as being in the University of Kansas collection, and that they could not be located there.

Remarks.—C. **abdominalis** is a rather variable species with a wide range in the Southwest. The antennae are black or to a variable extent reddish; the oral bristles of the mystax white or sometimes black. The thorax is reddish or black in ground color, the pollen appearing denser in the black forms. The legs are black or with a proximal portion of the tibiae reddish, rarely with the femora somewhat reddish proximally. Each abdominal segment laterally has from one to four bristles There is no correlation of this variation either with sex or geographic distribution. Members collected at the same time and place may exhibit such differences. The hind tibia of the male is more strongly arcuate than in the female. Curran has given a good description of the species. The length is from 9 to 14 mm.

McAtee doubted whether **similis** was a distinct species. All of the differences which Brown brought out seem to be well covered by variations in the material at hand. It appears to be entirely reasonable to consider **similis** a synonym of **abdominalis**. The types of **atripes** and **rufiventris** have been examined by the writer and found to represent the same species.

Specimens examined.—KANSAS: one female, Comanche Co., 1916, 2089 ft. (R. H. Beamer). OKLAHOMA: four males, three females, Vinson, July 9, 1934 (A. E. Pritchard); one male, Wichita National Forest, June 27, 1932 (O. Sandoz). TEXAS: one male, one female, Girvin, August 4, 1931 (R. H. Painter). NEW MEXICO: two females, Luna Co., July 14, 1934 (R. T. Kellogg); one male, Organ, August 8, 1931; one female, Alamagordo, June 30, 1932 (J. D. Beamer); one female, White Sands, July 23, 1933 (W. Benedict). ARIZONA: one male, San Carlos Lake, July (D. K. Duncan); one

female, Continental, July 15, 1938 (Jean Russell); one female, Arivaca, July 12, 1940 (D. E. Hardy); one female, Tuscon, July 23, 1938 (Jean Russell). CALIFORNIA: one male, Los Angeles (D. W. Coquillett); four females, San Bernadino Co. (D. W. Coquillett).

Cerotainiops oma, new species

Black in ground color, the mesonotum in part and the abdomen reddish or orange; legs black, the tibiae yellowish proximally; wings infuscated along the veins. Length, 8 to 13 mm.

Male.—Head black, white pollinose; vestiture white; mystax silky on face above tubercle, with long bristles on lower part, the oral bristles on either side brownish; palpi black haired. Antennae brown, the pedicel of the third segment pale yellowish. Thoracic pleura black, the meso- and metapleura nearly entirely bare of pollen, metapleural bristles long, brownish; upper margin of mesopleura reddish, white pollinose, clothed with rather long white hairs; notum reddish in ground color, the mesonotum with a geminate middorsal vitta slightly widened anteriorly and falling short of the scutellum posteriorly, and with a large black lateral vitta narrowly broken by the transverse suture; pronotum bare of pollen on either side; mesonotum bare of pollen except peripherally, a pair of small dots on the median vitta at the transverse suture and another pair anterior to this, sparcely but entirely clothed with recumbent whitish setae and with whitish lateral bristles; scutellum with disc yellowish pollinose and sparsely setose, the posterior margin dark brownish, bare of pollen, with a pair of long marginal bristles and a much smaller inner pair. Legs blackish, the tibiae pale yellowish on proximal third, the tarsi castaneous; moderately clothed with whitish bristles and white hairs. Wings lightly infuscated, darker along the veins, irregularly hyaline along posterior border. Abdomen largely reddish; proximal division of the first segment blackish and clothed laterally with black or brownish hairs; rest of abdomen clothed with short, recumbent, yellowish-orange setae; lateral pale bristles on each segment one or two. Genitalia reddish, blackish at distal end.

Female.—Similar.

Holotype.—Male, Los Angeles, California (D. W. Coquillett), in the U. S. National Museum.

Allotype.—Female, Los Angeles, California (D. W. Coquillett).

Paratypes.—One male, Los Angeles, California, May (D. W. Coquillett); one female, Santa Anna, California, June 17, 1938 (John Standish).

Remarks.—**C. oma** is related to **abdominalis** from which it differs in having the thoracic pleura largely bare of pollen, shining; mesopleura above with long hairs; metapleurals usually black; pronotum bare of pollen on either side; mesonotum with the disc practically

bare of pollen with the black vittae well differentiated in the ground color; mesonotal pollen more broadly surrounding the anterior humeri and with only two pairs of small inner spots representing the transverse lines of **abdominalis**; scutellum with one pair of marginal bristles and a smaller inner pair; and proximal division of the first abdominal segment black with lateral hairs usually black. The oral bristles of the mystax may be black as is sometimes the case in **abdominalis.**

Cerotainiops wilcoxi, new species

1919. **Nusa abdominalis** McAtee (not Brown), Ohio Jour. Sci., 19 (4): 247. Misidentification.

Thorax black or reddish in ground color, white pollinose, thinly so on the vittae, white pilose. Abdomen orange. Legs orange, the tarsi, distal ends of the tibiae and femora black. Wings essentially hyaline. Length, 11 to 14 mm.

Male.—Head black, cinereous pollinose, with white hairs and bristles; mystax dense and silky above, with long bristles below. Antennae brownish, somewhat paler proximally. Thorax black in ground color, the coxae and mesonotum except for wide vittae rather reddish; pleura entirely white pollinose, the hairs and bristles white; pronotum entirely white pollinose; mesonotum entirely white pollinose but thinner on geminate median and wider lateral vittae which are poorly differentiated, clothed with white setae except on the vittae, and with white lateral bristles, 2 presutural, 3 supra-alar, and 4 postalar; scutellum white pollinose, more thinly so on caudal margin, thinly white setose, with one pair of long white scutellars and a smaller inner pair. Legs orange, the anterior four femora above on distal third, the posterior femora on distal fourth, anterior four tibiae on distal third, posterior tibiae except for proximal third, and tarsi all blackish; clothed with white hairs and whitish bristles. Wings hyaline. Abdomen orange, yellowish setose above, each segment with one or two bristles laterally. Genitalia blackish distally.

Female.—Similar, the anterior four femora blackish on distal half.

Holotype.—Male, Tempe, Arizona, July (D. K. Duncan), in the collection of the University of Minnesota.

Allotype.—Female, Tempe, Arizona, August (D. K. Duncan).

Paratypes.—Five males, nine females, Tempe, Arizona, July-August (D. K. Duncan); two females, Phoenix, Arizona, August (D. K. Duncan); one female, Seaton, Arizona, August 8, 1930 (T. F. Winburn and R. H. Painter); one male, one female, Blythe, California, September 16, 1938 (F. H. Parker).

This species is named in honor of Mr. Joseph Wilcox who independently came to similar conclusions regarding the previous

misidentification of this species and the synonymy of **rufiventris** and **atripes.**

Remarks.—C. **wilcoxi** is closely related to **oma** and to **abdominalis** from both of which it differs in having the hairs and bristles of the body entirely white, the mystax denser; the hairs and bristles longer, especially on the legs; the thorax entirely pollinose with the vittae bare of setae; the legs in large part orange; the wings essentially hyaline.

C. **wilcoxi** is variable in coloration of the thorax and legs to a considerable extent, much as in **abdominalis.** The thorax is often entirely black. The anterior four femora vary from black at the distal end above to entirely black in one female from Tempe; the posterior femora are in no case with over the distal third blackish; the anterior four tibiae may be black on the distal half, and the posterior tibiae may be nearly entirely black.

LITERATURE CITED

Bromley, S. W. 1934 The robber flies of Texas (Diptera, Asilidae). Annals of the Entomology Society of America, 27 (1): 84, 103.

Brown, Barnum 1897. Two new species of asilids from New Mexico. Kansas University Quarterly, 6 (2): 103.

Curran, C. H 1930 New Diptera from North and Central America American Museum Novitates, 415: 11-12.

McAtee, W. L. 1919. Notes on the nearctic Nusa (Diptera, Asilidae). The Ohio Journal of Science, 19 (4): 244-248.

Ricardo, Gertrude. 1927. Notes on the two genera Nusa and Pogonosoma (Laphrinae). Annals and Magazine of Natural History, series 9, 20: 205-206.

NOTICE OF 18TH ANNUAL MEETING KANSAS ENTOMOLOGICAL SOCIETY

Due to a conflict of the Conference of Central States Entomologists with the meetings of the Kansas Academy of Science, the Kansas Entomological Society will be unable to meet with the Academy as has been the usual custom. Instead, the Society will hold their annual meeting at the Entomology Department, University of Nebraska, Lincoln, Nebraska on April 4.

All titles for papers to be presented at the meeting should be in the hands of the secretary not later than February 28. Please indicate the time requested for the presentation of the paper and whether or not a lantern is to be used.

D. A. WILBUR, Secretary

NOMOPHILA NOCTUELLA AS A GRASS AND ALFALFA PEST IN KANSAS (LEPIDOPTERA. PYRALIDIDAE).

ROGER C SMITH
Kansas State Agricultural Experiment Station, Manhattan, Kansas[1]

Nomophila noctuella D. and S. has no generally accepted common name, but it has been referred to as the "celery stalk worm" in Florida and the "soil web worm" in Kansas. Both names however are regarded as unsuitable in view of its habits and relationships. This species is one of the common moths of minor importance occurring in alfalfa fields and grasslands in Kansas. These moths can be most easily collected at lights and by sweeping in alfalfa fields and pastures, from the middle of April to about October 1. A study of this insect was begun in connection with the alfalfa insect project since its larvae feed to some extent on alfalfa. This report is a summary of observations made on its life stages in the field and laboratory in Kansas since 1920. One of the particular difficulties encountered during the earlier years was the confusion of the larval stages and habits of Nomophila with those of **Crambus vulgivagellus** Clem., **Stenoma mistrella** Busck and **Acrolophus** sp. This paper includes the distinguishing characters of these larvae.

Review of Literature

This species of moth is widely distributed over the world according to published information. It has been specifically listed from Europe, Algeria, Brazil and the whole of the United States.

Flint (1922) published a brief account of the life history and habits of this species. He reported damage to newly seeded fields of sweet clover in Illinois in 1919. He stated that there was a possibility of four generations a year with an average of 50 days each beginning with the hibernating larvae. The chief food plants of the species according to Flint, are red and sweet clovers and alfalfa, but in a few cases the larvae had been found on blue grass, purslane, corn, wild mustard, cinquefoil, white clover, fox tail and soybeans. The similarity of their feeding habits to crambids was mentioned. Spraying sweet clover with arsenate of lead, 2 lbs. to 50 gallons of water gave complete control.

Ellis (1925) included a brief synonmy of this species in his summarized account of the life history and description of stages with reference to distinguishing the larva of Nomophila from the European corn borer. He reported two generations each year for New England and overwintering in the larval stage in litter. Moths emerged during the last week in May while the second generation of moths occurred during July. "The larvae are taken

[1]Contribution No 504 from the Department of Entomology.

commonly from celery on the grooved side of the celery stalk and also apparently preferred the blanched and semi-blanched portions of the stalk. Only the outermost stems of the plant were observed to be infested." The damage was done by eating irregular shallow excavations on the stalk usually covering the area with silk. He stated that the larvae were surface feeders and did not burrow into the stalk. They moved equally well backward or forward in their burrows when prodded.

Drake and Decker (1927) stated that this world-wide moth was an occasional pest of little importance to legumes, bluegrass, foxtail, celery, corn and a number of other plants. They stated that there were probably three or four generations in the state of Iowa. Felt (1922) noted that the larvae fed mainly on legumes and had been found feeding in a few cases on blue grass, purslane, corn, wild mustard, cinquefoil and foxtail. Caffrey and Worthley (1922), Ellis (1925), Drake and Decker (1927), and Hutson (1934) reported the larvae as occurring and feeding on celery.

Observations on the Life History in Kansas

The moth has first appeared during these observations in the early part of April. They dart up from their hiding places when disturbed and fly erratically for several rods, alighting on a plant and quickly gaining cover by crawling on the under side of a leaf. The moth with folded wings appears (Fig. 2) relatively long and slender. It measures 12-17 mm. in length and has a wing spread of about 25 mm. The forewings are light brown or grayish-brown with three indefinite, chocolate brown, transverse bands. The under side of the costal margin of the forewing has four, generally prominent, equally spaced, black dots from the middle to the apex. Pinned and most field specimens are generally so badly rubbed that most wing spotting and bands are obscured. The wings when at rest are usually held transversely over the abdomen and the tips of the forewings generally overlap one another. The under side of newly emerged moths is lightly gray with three narrow longitudinal, brownish stripes on the abdomen, one in the mid-ventral line and a pair lateral to this one. These stripes can be seen through the pupal skin prior to the moth emergence. The head and thorax of rubbed specimens are shining, dark reddish-brown in color. Adults were never observed feeding in the field nor were they attracted to flowers.

The eggs of **N. noctuella** were glued to the substratum singly. in masses, or in rows, the latter predominating. The maximum egg deposition varied from about 80 to 142, the latter being the largest number obtained from any one female. The deposited eggs (Fig. 1) were variously shaped, generally oblong ovate, flattened

below and often somewhat angulate. When deposited in rows, they suggested a minature rope. The chorion was covered with a fine, mesh-like net-work and was highly iridescent, these reflections being quite marked. They were light green when first laid and changed to reddish-brown as embryonic development proceeded, eventually becoming almost black. The average size of ten eggs was 0.6 mm. in greatest diameter and 0.36 mm. smallest diameter.

The eggs hatched in 3 to 4 days in mid-summer. Flint (1922) observed an average egg period of 6 days. The larvae, immediately after hatching, began feeding on the epidermis of one side of the leaves of alfalfa, but later skeletonized the leaf. They also began at once to make small horizontal shelter tubes about the base of the plant. These consisted of silken webbings which incorporated particles of soil or small bits of rubbish just below or at the ground level. With respect to the webbing, they have the same general habits as "sod webworms" such as **Crambus vulgivagellus**, which is the common crambid in Kansas. The larvae spent the greater share of time within these shelter-tubes and were observed to cut off leaves and drag them to the shelter tubes where they fed upon them, while only their heads were exposed to view. The larvae were never taken by sweeping in the fields. They did not leave their shelter tubes except when disturbed or conditions were unfavorable to them.

The fully grown larva (Fig. 3) was somewhat grayish or greenish in color with prominent black spots on the body. The head capsule was black and the cervical shield was chestnut brown. Two rows of prominent black spots, four to a segment, occurred on the dorsal surface of the larvae, a row each side of the dorsal vessel. An unusually long seta arose from the center of each black spot. There was a second row of subdorsal black spots consisting of one pair of spots to each segment ventrad to the dorsal row. The spots were often irregular in outline and were always bordered by a narrow gray area. On the last two segments, the two dorsolateral spots occurring on each side of the other segments were fused into one. It was also margined by a narrow whitish area. There were four pairs of abdominal prolegs and a pair of anal prolegs.

The larvae were quite active, travelling backward and forward in their silken tunnels with equal facility. They molted five times and reached maturity under rearing conditions in about a month. Table I gives a summary of measurements for recognition of the various instars, while Table II gives a summary of molts and the length of the stages.

When larvae matured, under laboratory conditions, they spun

a cocoon which was only slightly larger than the pupa. Their cocoons incorporated bits of leaves and soil on the outside and had an inner, thin layer of silk which covered the pupa. The cocoons differed from those of **Crambus vulgivagellus** in that they were

Table I. Summary of measurements of 16 larvae of **Nomophila noctuella** for recognition of the different instars.

	Width of Head Capsule			Total Length		
	Least mm.	Greatest mm	Average mm	Least mm.	Greatest mm.	Average mm.
First Instar Larva	0.23	0.25	0.24	2	2.2	2.04
Second Instar Larva	0.34	0.37	0.35	2.2	3.5	2.7
Third Instar Larva	0.55	0.65	0.58	5.5	7.5	6.18
Fourth Instar Larva	0.80	0.87	0.84	9	12	9.42
Fifth Instar Larva	1.10	1.30	1.14	15	25.5	17.3
Sixth Instar Larva	1.76	1.85	1.80	23.2	27.2	24.75

Table II.—Summary of Length of Stages of **Nomophila noctuella** reared in the field laboratory during May and June.

	Average Days	Maximum Days	Minimum Days	Number of Formed averaged
Egg Stage	3	4	3	35
First Instar Larva	3.1	6	3	30
Second Instar Larva	2.3	4	1	30
Third Instar Larva	2.83	7	2	30
Fourth Instar Larva	2.3	7	1	29
Fifth Instar Larva	2.46	3	1	26
Sixth Instar Larva	4.33	8	1	24
Prepupa	1.37	2	1	24
Pupa	9.1	10	8	24

smaller, more loosely woven and were formed on a level with the surface of the ground. Cocoons of C. **vulgivagellus** were longer than those made by Nomophila, more tightly woven and usually occurred in a vertical position in the ground. **Stenoma mistrella** made similar cocoons also, but they differed from those of N. **noctuella** in that they were situated within the grass clump, the stems of which served to support the silken case. Pale green fecal material was usually present also near the upper end of these cocoons and they were never found below the ground. **Acrolophus** larvae constructed in the alfalfa fields vertical, silken tunnels two to five inches long which could readily be confused with N. **noctuella.** Often the empty pupal skins of **Acrolophus** were found protruding from the openings of these silken tunnels at the surface of the soil.

There was a prepupal period in **Nomophila** of about a day. The pupa (Fig. 4) measured from 3 to 3.5 mm. in diameter at the widest place and from 13 to 14 mm. in length. It was greenish in color for a day or two, gradually turning reddish-brown, but the posterior

portion generally remained yellowish-brown.

Newly emerged **Nomophila** adults had a more brilliant and sharply defined color pattern than characterized moths taken in the fields. Felt (1893) pointed out that four-fifths of the moths taken at lights were males. In these rearings, there was 16 males to 6 females indicating probably an excess of males in nature.

Egg deposition was begun within two or three days following emergence. Copulation occurred any time after emergence. The moths could be kept alive for as much as two weeks in cages by feeding them on dilute sugar water.

There was evidence of two generations in Kansas. The first generation occurred during late spring and early summer and the second during late summer or after the hot weather. Felt (1893) found three in New York, and Flint (1922) reported four in Illinois. It has been difficult to follow this insect with any degree of accuracy in the field because moths were present nearly continuously from the early part of April until late October. The authors mentioned above stated that the species overwintered as partly grown larvae in tunnels. No data could be obtained on this point in Kansas, but early occurrence of adults appears to indicate overwintering as larvae.

Table III shows larval differences of the species which may be confused with **Nomophila.**

Feeding habits of Nomophila larvae

This species was present on several occasions when extensive insect damage was done to grass lands during April, May and June in Kansas. There is no evidence that they were wholly responsible for any observable, serious damage to grass or alfalfa. The larvae appeared to have overwintered in the thick mats of grass and did their injury in the spring by devouring the early green growth when they completed their growth. Such injury has often been mistaken for cut worm and army worm damage.

One of the earlier reports of extensive injury to which Nomophila contributed occurred at Great Bend, Kansas, the latter part of April, 1932 in a field of 40 acres of June grass (prob. **Koeleria cristata** (L)). From the description, it appears that all the green foliage was destroyed and that the larvae ate for a time on the roots of dead stems. However, most of them migrated and gave the field the appearance of waves of devastation moving across the field. Larvae of Crambids also occurred in the field but they perhaps were second in importance. The injury was comparable to a severe attack of army worms. Franklin gulls ate many of the larvae following harrowing the field.

The second instance of injury in which this species was concerned with Crambids occurred at Williamsburg, Kansas, the latter part of April, 1938. A field of approximately 40 acres of blue grass

TABLE III*

Identification characters of the species of caterpillars in Kansas likely to be confused with **Nomophila.**

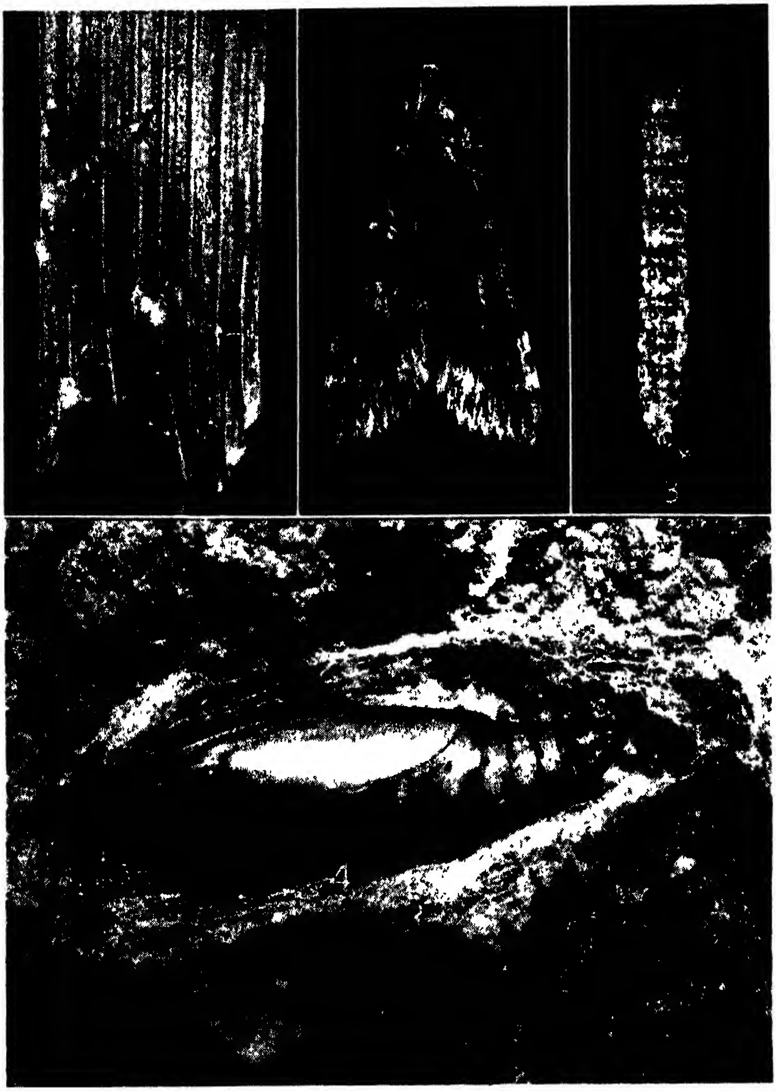
Name	General coloration	Arrangement of spots and stripes	Head and Cervical Shield	Crochets	Differences in setal pattern on abdominal segments VIII and IX	Length of clypeus	Texture of head capsule	Shape of frons.
Nomophila noctuella	Grayish with black spots	Seta bearing spots arranged in 4 longitudinal rows —4 spots to each segment on the dorsal surface arranged as a square; a pair also on each segment laterad constitutes the two outer rows.	Head shining black; cervical shield dark brown	Tri-ordinal hooks	AVIII has setae IV and V located above setae VI. AIX has setae I and V absent.	2/3 length of head capsule. Basal border slightly concave.	Smooth	Follows the clypeal border very closely.
Crambus vulgivagellus	Grayish brown with black spots	Seta bearing spots somewhat staggered so that definite longitudinal rows are observable. Variation in shape and number of other setal spots within the species occurs.	Black head and cervical shield. Color varies in other species of same genus.	Tri-ordinal hooks	AVIII has setae IV and V in front of seta VI. AIX has setae I absent and setae IV and V are combined.	2/3 length of head capsule. Basal border straight.	Smooth	Narrow with a light band on lateral and dorsal edges.

TABLE III (Concluded)

Identification characters of the species of caterpillars in Kansas likely to be confused with **Nomophila noctuella**

Name	General coloration	Arrangement of spots and stripes	Head and Cervical Shield	Crochets	Differences in setal pattern on abdominal segments VIII and IX	Length of clypeus	Texture of head capsule	Shape of frons
Stenoma mistrella	Pinkish-brown with longitudinal stripes	One longitudinal stripe on dorso-median surface and two smaller lateral stripes. Spots are also present which are somewhat staggered and much smaller than in **C. vulgivagellus** and **N. noctuella.**	Head and cervical shield deep chestnut brown. Cervical shield has a light band on anterior border.	Tri-ordinal hooks	AVIII has setae IV and V in front of seta VI. AIX has setae I and V present.	1/3 length of head capsule. Basal border slightly concave.	Dark brown blotches, scale-like.	Dorsal half contiguous. Ventral half wide.
Acrolophus sp.	Solid coloration of light brown having a velvety appearance.	No stripes nor spots.	Black head and cervical shield. Head usually partly retracted under cervical shield.	Single row of hooks	AVIII has setae IV and V back of setae VI. AIX has all setae present. Two individual setae combine to form seta VII.	1/2 length of head capsule. Basal border straight.	Deep half moon fissures	Wide with lateral and medial edges inverted V-shaped.

*Prepared by H. D. Oliver Miller



EXPLANATION OF PLATE

1. Eggs of **Nomophila noctuella** D. and S. deposited in cages. They are glued to a blade of grass.
2. Recently emerged moth of the above species.
3. Dorsal view of the full grown larva of **Nomophila noctuella.** Note the six spots per segment and the two dorsal longitudinal rows which they form.
4. Pupa of the same species. The inner silken cocoon has been cut open to expose the pupa.

and wild oat pasture was wholly destroyed. Overwintering larvae spread from the old grass sod where they had wintered and ate every spear of grass in the field. Specimens of the larvae were identified from the field as this species. There were some other web worms and cut worms in the field also, but identification of them was not possible. The correspondent spoke of the larvae living in webbing around the base of the plant. Such injury had not previously occurred in the region. An attempt to destroy them by burning was unsuccessful. The land was disked and put in Sudan grass.

A third instance of destruction and of severe damage presumably by this species occurred in a 20-acre pasture at Abilene, May 9, 1938. Larvae were not seen but the description of the webbed tubes on the ground around the grass clumps and of the larvae retreating backwards into the tubes when disturbed, strongly suggested this species. Plowing up or disking and planting to sorghum was recommended where the damage was severe.

Serious injury was done to 30 acres of pasture near the western border of Osage County in early June, 1938. All the larvae had developed to moths when the pasture was visited but **Nomophila** moths were exceptionally plentiful. The owner stated that on several occasions a week or 10 days earlier, a layer of dead moths said to have been of the flying species covered the water tank each morning. An oats field and a neighboring pasture of 160 acres were also damaged but buffalo grass in the pastures appeared to be uninjured. White grubs were present in small numbers only.

Larvae were seen from the first two fields but at the time the writer could not distinguish between larvae of **Nomophila** and **Crambus.** Recent re-examination of the preserved larvae indicated that both species had been present In the laboratory, **Nomophila** larvae placed on potted plants of brome grass and Kentucky blue grass failed to mature, while the larvae under similar conditions on potted alfalfa plants grew to maturity. They also fed on the brome grass, but no signs of feeding could be found on the Kentucky blue grass.

The moths are often common in alfalfa fields but no damage to this crop in the field has been observed. No opportunities for field observations near at hand and control experiments have been available. The importance of **Nomophila** in Kansas is that it is a potential pest of consequence to alfalfa and some grasses.

LITERATURE CITED

Ainslee, G G. Crambid moths at lights. Jour. Econ. Ent. 10: 114-123. 1917.

Caffrey, D J. and Worthley, L. H The European corn borer and its control. U. S. Dept. Agr. Farmers' Bulletin 1294 45p. 1922.

Dean, G. A. and Smith, R. C. Insects injurious to alfalfa in Kansas. 29th Bien. Rpt. Kans. State Bd. Agric. 34: 202-249 1935.

Drake, C. J. and Decker, G. C. Some caterpillars frequently mistaken for European corn borer. Iowa State Col. Agric. and Mech. Arts Agric. Expt. Sta

Cir. No 103 16p April, 1927.

Ellis, W. O. Some Lepidopterous larvae resembling the European corn borer. Jour. Agric. Res 30(8) 777-792. April, 1925

Felt, E. P. **Nomophila noctuella** Schiff. Can. Ent. 25: 129-134 1893

Flint, W. P Studies on the life history of **Nomophila noctuella**. Ann. Ent. Soc. Amer 15(2). 154-156 June, 1922.

Franklin, H J. Seventh report of cranberry substation from 1917 to 1919. Mass. Agric Expt Sta. Bul 192 105-141. October, 1919.

Hutson, R Report of Entomology Section 73rd Ann Report Mich. State Board Agric. 73 210-222 June, 1934

Kruger, G. Frammenti di entomologia cirenacia. Agric. Colon 28(9) 460-463. September, 1934.

McDunnough, J. Check list of Lepidoptera of Canada and U S. A. Part II. Memoirs of Southern Calif Acad. Sci. 2(1). 12 1939.

Miller, H D O Observations on **Stenoma mistrella** Busck (Stenomidae, Lepidoptera). Jour. Kans Ent Soc. 13(1) 1-3 January, 1940

——— Observations on sod web worms in Kansas Trans Kans Acad of Science 43 267-281 1940

Smith, R C. and Kelly, E. G A summary of the population of injurious insects in Kansas for 1932 Jour. Kans Ent. Soc 6(2). 37-60 1933

A NOTE ON LEAFHOPPER ABUNDANCE

While scouting for Pear Psylla in Yakima Valley, Washington, this fall the writer and Mr. F. C. Harmston made an interesting observation of insect nuisance due to abundance.

At White Swan, Washington, the townspeople were caused a great deal of annoyance during the latter part of October and the first few weeks in November by the presence in enormous numbers of a large leafhopper, **Cicadella hieroglyphica** var. **confluens** (Uhler). This species became so abundant around the vacinity that the trees, sides of houses, buildings, fence posts, etc. would be blackened by them. Each time a person opened a door the leafhoppers swarmed into the houses. One man had attempted to paint his house and the insects became lodged by the thousands in the white paint. The town is apparently confronted with this situation each fall and the residents have become so concerned about it that they are attempting to raise a fund to cover the cost of eradication of this leafhopper in that community.

The region is arid, with few trees except in the town and as the leafhoppers are in flight preparing to enter winter quarters the village becomes a focal point for their swarms, as that is the most likely place for them to find shelter. A small creek runs through the town and the swale is lined with willows, this is apparently the source of infestation as P. W. Oman states that this species lives entirely on willows.

D. ELMO HARDY, Lawrence, Kansas

A NOTE ON ADELOCEPHALA BICOLOR (HARR.)
(Lepidoptera: Saturnioidea)

DON B STALLINGS and DR J R TURNER, Caldwell, Kansas

Adelocephala bicolor (Harr.). This species with its various forms is triple brooded in south-central Kansas. It appears from the notes that follow that as a general rule each brood has physical characteristics by which it may be determined.

Adelocephala bicolor f. suprema (Neum.). This is the vernal or spring form of **bicolor.** Unfortunately when this form was described an intermediate specimen was used which had the characteristics of both the spring and summer form. **Suprema** was described as having the head, thorax, abdomen and legs pearly grey, with the primaries brown, shading into pearl grey. Actually the normal coloring of the spring form is for the ground color of both body and wings to be grey without any brown at all, the grey tending more to smoke than to pearl. **Bicolor** has the ground color a yellowish-brown, both **bicolor** and **suprema** have the upper surfaces of the forewigs and the under surfaces of the hindwings speckled with darker coloring. We have seen the spring form occur without the speckling on the wings. There are all kinds of intergrades between **bicolor** and its form **suprema.** We have specimens that are normal **bicolor** in every respect except that the legs are grey. On the other hand we have specimens that are of the normal spring form except that the abdomen is yellowish-brown. This spring form flies from April 25th to May 15th, however we have a single specimen taken August 23rd. Wing expanse of the male varies from 35 mm. to 48 mm. with 45 mm. being the average. Wing expanse of the female varies from 49 mm. to 65 mm. with 56 mm. being average.

Adelocephala bicolor f. immaculata (Jewett). This form differs from **bicolor** in lacking the darker speckling on the wings, hence its name. The ground color is a lighter yellowish-brown than is **bicolor.** This form normally occurs in the first summer brood which flies from June 20th to July 10th, although we have specimens taken as late as August 23rd. From breeding experiments it appears that approximately 50% of the first summer brood are typical of form **immaculata** and the remaining specimens have lighter ground color and much less of the dark speckling than does **bicolor.** Unfortunately we have not been able to take sufficient specimens in nature of this first summer brood to determine whether the above mentioned percentage holds true in nature. Wing expanse of the male varies from 32½ mm. to 50½ mm. with 37 mm. being the average. Wing expanse of the female varies from 40 mm. to 47 mm. with 45 mm. being the average.

Adelocephala bicolor (Harr.). This is normally the second summer brood flying from August 10th to Sept. 2nd, although we have specimens taken as early as May 17th. It is interesting to note that although both honey-locust and coffee-bean trees (the two food plants of **bicolor**) occur in this vicinity, we have no evidence that they ever feed on honey-locust; all larvae and ova that we have found in nature were on the coffee-bean tree. We plan some experiments this coming season with honey-locust. Wing expanse of the male varies from 35 mm. to 52 mm. with the average at 43½ mm. Wing expanse of the female varies from 44 mm. to 62 mm. with the average at 55 mm.

RACIAL VARIATION IN HEMIARGUS ISOLA (REAKIRT) (Lepidoptera: Lycaenidae)

WILLIAM D. FIELD, Lawrence, Kansas*

The writer has recently had the opportunity of studying a series of thirty specimens of **Hemiargus isola** (Reakirt) taken on September 23rd, 1938 at Rio del Monte in the state of Hidalgo, Mexico by L. J. Lipovsky. A comparison of this series with a large series from Kansas, Texas and Colorado and from Naica in the state of Chihuahua, Mexico and Chapula and Cocula in the state of Jalisco, Mexico clearly shows to distinct subspecies.

Typical **isola** was described by Reakirt[1] from near Vera Cruz, Mexico. This name will apply to the Rio del Monte specimens. The name **Lycaena alce** Edwards[2] based upon specimens of this species from Colorado[3] is available for the subspecies found in the United States and northern and western Mexico.

Typical **isola** is slighlty larger than **alce**, having a wing expanse in the male sex of 24 millimeters. The one female in the series from Rio del Monte has an expanse of 27 millimeters. A series of typical **alce** from Colorado, Kansas and Texas and from the states of Chihuahua and Jalisco in Mexico was measured and found to have an average expance of 22 millimeters in the male sex and 24 millimeters in the female sex.

The most striking difference between the two subspecies is in the ground color on the undersurfaces. In typical **isola** it is a dark grey while in **alce** this color is brownish grey, sometimes almost white. The palpi, underside of thorax and abdomen in **alce** are white, in **isola** grey.

*Contribution from the Department of Entomology, University of Kansas.

[1] Pr. Acad. Nat. Sci. Phil., p. 332, 1866.

[2] Tr. Am. Ent. Soc., 3, p. 272, 1871

[3] F. Martin Brown, places the locality of Edwards' type specimens, collected by T. L. Mead, as Turkey Creek, Jefferson Co. and Georgetown, Clear Creek Co., Colorado. See, Jr. N. Y. Ent. Soc., XLII, p. 162, June, 1934.

REPRINT PRICES

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

Pages	1-2	3-4	5-8	9-12	13-16	17-20	21-24	25-28
50 copies	$1.10	$1.40	$3.85	$5.25	$7.45	$ 9.65	$11.85	$14.05
100 copies	1.40	1.65	4.15	5.80	8.00	10.20	12.40	14.60
200 copies	1.65	2.20	4.95	7.15	9.35	11.55	13.75	15.95
100 Add'n'l	0.55	1.10	2.20	3.30	4.40	5.50	6.60	7.70

Tables—for setting up—$1.25 per page extra.

Covers, per 100—$2.50

Fifty copies of reprints are free to the authors provided at least 50 copies are purchased. Reprints should be ordered in lots of 50 or multiples thereof.

Postage or express charges on carriage of reprints are extra

PRICE OF BACK VOLUMES

Volume 1 ....$2.00
Volumes 2 to 7 inclusive 1.00
Volumes 8 to date 1.50

Subscriptions for back volumes or numbers should be sent to Donald A. Wilbur, Entomology Department, Kansas State College, Manhattan, Kansas.

CONTENTS OF THIS NUMBER

JOURNAL OF THE
KANSAS ENTOMOLOGICAL SOCIETY

A quarterly journal published in January, April, July and October devoted to Entomology in the Western Mississippi Basin and the proceedings of the Kansas Entomological Society.

Manuscripts for publication may be sent to any of the publication committee.

The Kansas Entomological Society does not make exchanges since the Society does not maintain a library.

Subscription to the Journal must be paid in advance. The subscription rate is so low that second notices are not ordinarily sent out.

Payment of Canadian or other foreign subscriptions and bills must be made by international Postal Money Order or by a draft on a New York bank and payable in U. S. A. dollars.

Subscribers are urged to give us their full cooperation in these matters.

Subscriptions should be sent to Donald A. Wilbur, Entomology Department, Kansas State College, Manhattan, Kansas.

Subscriptions in the U. S. A.,	**$1.50 per year**	**Single Copy**
Canadian or foreign subscriptions,	**1.75 per year**	**60 cents**

Vol 15, No. 1, January, 1942

VOL. 15 APRIL, 1942 NO. 2

Journal

OF THE

Kansas Entomological Society

JAMES WALKER McCOLLOCH
1889-1929

Entered as second-class matter June 7, 1939 at the Post Office at Manhattan, Kansas, under the Act of August 24, 1912

Kansas Entomological Society

Volume 15 | April, 1942 | Number 2

COLEOPTERA ASSOCIATED WITH IRONWEED, VERNONIA INTERIOR SMALL IN KANSAS*

R. B. SCHWITZGEBEL and D. A. WILBUR,
Kansas Agricultural Experiment Station, Manhattan, Kansas[1]

A knowledge of the species, life histories and habits of the insects of the prairie or any grassland habitat is difficult to obtain because of the large number of different plants involved. Before such knowledge can be realized it is first necessary to reduce the grassland complex into its various plant elements and determine the insects associated with each plant species.

For several decades **Vernonia interior** Small has been one of the more important pasture weeds in Eastern Kansas, ranking along with sumac, vervain, buckbrush, and ragweed. A survey of the insects associated with ironweed and a study of their biology and habits was begun June, 1939, and continued through June, 1941. The following discussion concerns the 47 species of Coleoptera which were either feeding on some portion of the plant or utilizing its heavy foliage for shelter.

Vernonia interior Small, a member of the composite family, is a coarse, erect perennial with alternate leaves. Its purple to rose blossoms may be seen in the prairies, pastures, and wastelands of Kansas from July to September. According to Gates (1940) **V. interior** has been reported from all counties in Kansas except 21 in the western and southwestern parts of the state.

Concerning the propagation and growth of ironweed Aldous (1935) says "ironweed is first established by seed and then spreads rapidly by thrifty root stalks to form a clump frequently containing 100 stems. The roots of ironweed do not penetrate the soil more than three or four feet, even in fertile soil most of the roots are concentrated in the surface foot. This weed is able to grow under extremely dry conditions. It starts growth early in the spring ahead of most of the native forage plants."

The height of the plant varies from three to six feet, depending on its environment. It usually averages three or four feet in most of the upland pastures.

Sources of ironweed for this study included several pastures north of Manhattan, and a sandy upland pasture in western Pottawatomie County, known as the Little Gobi Desert. Collections

*Contribution No. 506 from the Department of Entomology.

[1]This investigation was conducted in part in connection with Project 211, Bankhead-Jones, of the Kansas Agricultural Experiment Station.

and field observations were made about twice each week during the growing seasons of the two year period of investigation.

Stems were opened in the laboratory and examined to determine the species, stage of development, and abundance of the borers present. In April and May larvae and pupae of the Coleopterous stem borers were collected from the previous year's stems, placed in vials, and kept in a dark place until emergence of adults and their parasites. The shoe box method (Wilbur and Fritz, 1939) was used to rear the mordellid borers and their parasites.

Order Coleoptera

At least 13 species of Coleoptera including three Cerambycidae, one Mordellidae, four Curculionidae, one Elateridae, two Scarabaeidae and two Meloidae were observed feeding on ironweed. Thirty-four additional species of Coleoptera comprising 13 families have been collected from ironweed but their relationship to this plant was not determined.

Family CERAMBYCIDAE* Two members of this family, **Ataxia hubbardi** Fisher and **Hemierana marginata** ab. **ardens** (Lec.), burrowed in the stems. Another species, **Hippopsis lemniscata** (F.), was found in a burrow made in an ironweed stem but was taken only once. Kelly (1931) reported that **A. hubbardi** and **H. lemniscata** fed in stems of cocklebur (Xanthium spp.). *Identified by W. S. Fisher.

Ataxia hubbardi Fisher. The larva was whitish with dark brown mandibles. When full grown it averaged about 2 to 3 mm. in diameter and 18 mm. in length. Occasional individuals were 24 mm. long. Mature larvae of **A. hubbardi** could be distinguished from the larvae **H. marginata** by the presence of a fleshy spine on the tip of the abdomen of the former (Fig. 4 and 5). The younger borers did not exhibit their character. The pupa was bare and slightly shorter and thicker than the mature larva. The adult was reddish-brown with some lighter markings on the elytra and varied from 10-14 mm. in length (Fig. 1 left).

EXPLANATION OF FIGURES IN PLATE I

Fig. 1. Adults of **Ataxia hubbardi** (left) and **Hemierana marginata** ab. **ardens** (right).

Fig. 2. Longitudinal section of ironweed stem showing larvae of **Hemierana marginata** in its burrow which was plugged above and below larva to form an overwintering chamber. (Puparium shown just above the larva is that of a dipterous stem borer, **Agromyza** sp.)

Fig. 3. Longitudinal sections of ironweed stems showing burrows of **Mordellistena pustulata.** Stem at left was not infested.

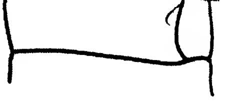
Fig. 4. Side view of tip of abdomen of **Ataxia hubbardi** larva.

Fig. 5. Side view of tip of abdomen of **Hemierana marginata** larva.

1

2

4



Although no eggs were found, oviposition probably occurred during June since larvae were found in the stems as early as the second week in July.

In July the larvae hatched and began feeding in the pith about halfway up the stem. They burrowed downward through the pith to the crown making an irregular spiral path. The larvae fed until the last of September and overwintered in the stem near the crown as full grown individuals. Larvae in the smaller stems left only the hard outer tissues when their feeding activities had ended. Since the borers fed only in the pith during most of the growing season, it is thought that little injury resulted from their feeding activities. The burrow was plugged with frass above and below the borers to form their overwintering cell. Pupation occurred during the last of April and the first of May. The average length of the pupal stage in the laboratory was 15 days.

Fifty-one A. **hubbardi** and H. **marginata** larvae were found in 128 stems selected at random from several pastures during the growing season. This sample indicated that about 40 per cent of the plants were hosts to the cerambycid borers. There was only one borer in each infested stem.

Of the 33 larvae and pupae which were reared successfully, all except four were A. **hubbardi.** These were the only data indicating the relative abundance of the two species.

Hemierana marginata ab. **ardens** (Lec.). When full grown the larvae averaged 15 mm. in length and 1.75 mm. in diameter. The abdomen was white and the head and thorax yellow. The bare pupa was slightly smaller than the larva. The adult was black with orange markings on the head, thorax, and antennae (Fig. 1).

The life history and feeding habits were similar to those of A. **hubbardi.** The full grown larvae overwintered near the crown of the plant sealed in individual cells (Fig. 2). Pupation occurred in April and May and the adult emerged in about 10 to 14 days. Adults were collected on the plant in June and the larvae of the following generation were found inside ironweed stems about the middle of July.

Several specimens of **Monogonogastra agrili** (Ashm.) (Braconidae) were collected or reared from pupae of A. **hubbardi** and H. **marginata** in May. One specimen of **Iphiaulax** sp. (Braconidae), identified from the cocoon, was also a primary parasite of the stem borers. From this specimen there emerged six hyperparasites, **Merisus** n. sp. (Pteromalidae) on May 26. Only six parasitized cerambycids were found in the field and in each instance a silky cylindrical cocoon about one inch long was formed about the host.

Hippopsis lemniscata (F.) The one larva of H. **lemniscata** collected in November from a V. **interior** stem was 13 mm. long and 1.5 mm. in diameter. The head and prothorax were pale yellow and the rest of the body whitish. Brown hairs were present on the underside and on the last abdominal segment. The burrow of this larva was similar to those of the other two cerambycids.

Concerning this species, Blatchley (1910) gave the following desciiption and note:

> Elongate, very slender, cylindrical, dark reddish-brown; thorax with two white lines on each side; elytra each with three whitish lines, antennae more than twice the body length. . . length 10-13 mm. May 28-June 7. Breeds in stems of ragweed (**Ambrosia**); also in tickweed and burmaiigold (**Coreopsis and Bidens.**).

Family MORDELLIDAE.* Four species of this family were collected from ironweed, **Mordella insulata** Lec., **Mordellistena sericans** Fall, **Mordellistena pustulata** Melsh., and **Mordellistena** sp. Adults of **M. pustulata**, the only species reared and observed feeding, were collected in large numbers. *Identified by H. S. Barber.

Mordellistena pustulata. The larvae was 7-9 mm. long when full grown and about 1.0 mm. in diameter. The body varied from white to cream in color with a yellowish head capsule and dark brown mandibles. The bare white to yellow pupa was about the same size as the larva. The adult was 2-3 mm. in length, black, with elytra spotted with silvery pubescence.

Although the larvae were numerous they probably did not cause seiious injury to the plant. Their crooked, winding burrows were usually found in the upper two-thirds of the stem and varied in length from 5 to 29 inches with an average of 18 inches. (Fig. 3). The maximum burrow width was 2 mm. with the major portion of the burrow about one-half that size. For most of its length the burrow was filled with light colored frass. Larval activity began in the upper part of the stem and in no instance did the burrow extend below the crown.

The larva overwintered in its burrow in the pith usually in the lower half of the stem. It pupated in the spring within the stem, and the adult emerged in May. There was only one generation each year. No eggs were found but they were probably inserted in the stem during June, since the adults were most abundant about that time. By tracing the burrows of the young larvae it was determined that the eggs were laid just below the junction of the petiole with the stem. As a result of oviposition a tiny brown scar was left on the stem. It was evident that a few eggs were laid in the petioles and midribs since burrows could be traced to those structures. The

earliest date that larvae were taken from the stems was the first week in July.

Of the 103 stems examined near the end of the growing season, 99 were hosts to at least one borer. Usually there were more than one borer per stem and the maximum was seven. Two hundred and ten larvae were taken from the 103 stems which indicated the average population was about two per stem.

Forty individuals of the genus **Schizoprymnus** (Braconidae) were reared from **M. pustulata** pupae. According to C. F. W. Muesebeck, who made the determinations of these specimens, they were apparently undescribed. The only indication of the percentage of parasitism was the fact that four times as many parasites were reared as were beetles. The emergence of the parasites was simultaneous with the emergence of the hosts.

Family CURCULIONIDAE.* Adults of **Rhodebaenus tredecimpunctatus,** Ill. and **Pantomorus pallidus** Horn were found associated with ironweed. Blatchley and Leng (1916) reported having taken these species along with **Anametis setosus** B. & L. and **Aulobaris scolopax** Say on ironweed in Indiana. Nine other species of Rhynchophora were collected from **V. interior** but their relationship to the plant was not learned. *Identified by L. L. Buchanan.

Rhodebaenus tredecimpunctatus. Four adults of this insect generally known as the cocklebur billbug were taken from ironweed near Manhattan during the spring. No other stages were found associated with the plant but the feeding punctures made by the adults were observed. Kelly (1931) reported the insect on cocklebur, (Xanthium spp.). Blatchley and Leng (1916) described the adults and reported that they were common throughout Indiana from April 17 to October 6 when they could be taken in the axils of the leaves of ironweed in the stems of which they are said to breed. They stated that these beetles not only breed in cocklebur and other species of **Xanthium** but also in many other Compositae such as joe-pye weed, leaf cup, sunflower, thistle, greater ragweed and rosin weed.

Pantomorus pallidus Horn. Adults of this species were observed feeding on the terminal growth of ironweed in June. No other stage of this insect was found associated with the plant. Blatchley and Leng (1916) reported that **P. tesselatus** Say var. **pallidus** was swept from ironweed and gave a description of the adult.

Family **MELOIDAE.** Two species of blister beetles, **Macrobasis immaculata** (Say) and **Epicauta cinerea** (Forst)., were observed feeding on **V. interior** July 18, 1940. Twenty-three individuals had almost completely defoliated the plant on which they fed. On other occasions throughout the growing season blister beetles were observed

and collected from ironweed leaves but usually only one or two specimens at a time.

Family **ELATERIDAE.** One wireworm, **Melanotus** sp. was observed feeding on the roots of ironweed in April and an adult of the same genus was collected from a plant in August.

Family **SCARABAEIDAE.** White grubs were found feeding on roots of ironweed on several occasions. They were a species of **Phyllophaga**, and probably the wheat white grub, **P. lanceolata** (Say). Adults of this species were taken while feeding on ironweed leaves in June. According to Hayes (1919) ironweed is apparently an important food plant of the wheat white grub in the pastures. He also reported in the same paper that there was evidence that the females preferred to lay their eggs at the base of the ironweed plant. In one case 81 eggs were found within a radius of two inches from an ironweed plant and in the first eight inches of soil. Hayes (1920) reported ironweed as a food plant of **Phyllophaga crassissima** (Blanch). McCulloch (1923) collected adults of **P. crassissima, P. rubiginosa** Lec., **P. bipartita** Horn, and **P. hirticula** var. **comosa** from ironweed and reared **P. crassissima** from a grub collected from ironweed roots.

Other Coleoptera collected from ironweed are:

Histeridae		
Phelister subrotundus Say	1 specimen	May
Cantharidae		
Cantharis sp.	1	May
Melyridae		
Collops quadrimaculatus (F.)	1	May
Cleridae		
Hydnocera pubescens Lec.	30	July-Aug.
Mordellidae		
Mordella insulata Lec.	5	June
Mordellistena sericans Fall	8	May-June
Mordellistena sp.	2	June
Meloidae		
Zonites bilineata Say	1	Aug.
Buprestidae		
Acmaeodera pulchella (Host.)	14	July-Aug.
Dermestidae		
Attagenus sp.	1	June
Cerambycidae		
Tetraopes tetraophthalmus (Forst)	4	June
Mecas inornata (Say)	1	June
Chrysomelidae		
Aphthona texana Cr.	1	July
Cryptocephalue quadrimaculatus Say	2	June
Diabrotica longicornis (Say)	6	Aug.
Diabrotica 12-punctata (Fab.)	7	Aug.
Glyptina sp. prob. **spuria** Lec.	1	July
Metriona sp. prob. **atripes** (Lec.)	1	Aug.

Oedionchis sp. prob. miniata (F.)	1	May
Pachybrachis sp.	15	May-Aug.
Zygograma saturalis (F.)	6	July
Anthribidae		
Brachytarsoides sp.	1	Aug.
Curculionidae		
Apion oblitum Smith	1	June
Baris sp.	1	July
Centrinaspis sp.	1	Aug.
Conotrachelus leucophaeatus Fahr.	1	Aug.
Epicaerus imbricatus	4	May-July
Pseudobaris farcta Lec.	21	July-Aug.
Smicronyx fulvus Lec.	8	Aug.
Smicronyx sp.	6	Aug.

SUMMARY

1. At least 47 species comprising 14 families of Coleoptera are associated with ironweed, **Vernonia interior** Small, directly by feeding on the plant or indirectly as visitors.

2. At least thirteen of these species fed on some portion of the plant. Aproximately 40 per cent of the stems of ironweed examined were infested by one of the three Cerambycidae, **Ataxia hubbardi, Hemierana marginata ab. ardens,** and **Hippopsis lemniscata.** One Mordellidae, **Mordellistena pustulata,** was found in 96 per cent of the stems examined. Two Meloidae, **Macrobasis immaculata** and **Epicauta cinerea** fed on the leaves. Four Curculionidae, **Rhodebaenus 13-punctatus, Pantomorus pallidus, Aulobaris scolopax,** and **Anametis setosus** fed on the stems and terminal growth. Two Scarabaeidae, **Phyllophaga lanceolata,** and **P. crassissima** fed on the roots as did one Elateridae **Melanotus sp.**

LITERATURE CITED

Aldous, A. E. Management of Kansas permanent pastures. Kans. Agr. Expt. Sta. Bul. 372. 44p. 1935.

Blatchley, W. S. Coleoptera known to occur in Indiana. Indianapolis. Nature Pub. Co. 1369p. 1910.

Blatchley, W. S. and Leng, C. W. Rhynchophora or weevils of Northeastern America. Indianapolis. Nature Pub. Co. 682p. 1916.

Gates, Frank C Flora of Kansas. Topeka. Kans Agr. Exp. Sta. 254p. 1940.

Hayes, W. P. Life-cycle of **Lachnosterna lanceolata** Say. Jour. Econ. Ent. 12:109-117 1919

——— Life histories of some Kansas Lachnosterna. Jour. Econ. Ent. 13:303-318. 1920.

Kelly, S. G. Control of Noogoora and Bathurst burr by insects. Jour. Council Sci. Ind. Res. 4(3):161-172. 1931.

McColloch, J. W. Phyllophaga of Manhattan. Unpublished thesis. Kansas State College. 1923.

Wilbur, D. A. and Fritz, R. F. Use of shoebox emergence cages in the collection of insects inhabiting grasses. Jour. Econ. Ent. 32:(4)571-573. 1939.

NOTES ON NORTH AMERICAN RHINOPSYLLA WITH DESCRIPTION OF A NEW SPECIES (PSYLLIDAE: HOMOPTERA).

L. D. TUTHILL, Iowa State College, Ames, Iowa

The genus **Rhinopsylla** is poorly represented in most collections of Psyllidae. Due principally to this paucity of material, numerous errors have been made by all those who have worked with the group. As the author makes no claim of infallibility some of the conclusions recorded in this paper may later prove to be erroneous. Some previously made errors are corrected however.

Rhinopsylla schwarzii Riley

1885 **Rhinopsylla schwarzii** Riley, Proc Biol Soc Wash II 78
1911 **Rhinopsylla schwarzii** Crawford, Pom Coll Jour Ent III 441.
1914 **Rhinopsylla schwarzii** Crawford, U S N M. Bull 85 59.
1938 **Rhinopsylla schwarzii** Brimley, Ins N C. 103

Length to tip of folded wings 3-3.5 mm.

Color: General body color red to brown. Abdomen green, darker dorsally. Tibia and tarsi white. Segments I and II of antennae red, III, IV, and V white, remainder dark. Wings glistening, hyaline.

Structure: Head very deeply cleft anteriorly, narrower than thorax. Vertex very narrow basally, with deep oblique sulcus on each side from near base toward antero-lateral margin between antenna and eye. Eyes protruding, anterior; posterior margin even with lateral ocelli. Genae slightly produced beneath antennae. Antennae large, almost three times as long as width of head, segments III and IV thickened, remainder slender. Thorax moderately arched. Pronotum narrow, above plane of vertex. Prothoracic episterna strongly produced anteriorly, in dorsal view appearing collar like. Forewings small, slender, acutely pointed, about three times as long as wide; costal margin strongly curved; Rs short, slightly arched to costal margin; cubital cell larger than medial; radular areas prominent. Hind wing slender, exceeding abdomen. Legs long. Forefemora greatly enlarged in both sexes, sometimes appearing flattened and curved due to collapse. Hind tibia with a minute basal spur, one outer and two inner apical spines. Metacoxa with short, rounded anterior processes.

Genitalia: Male genitalia small. Proctiger short, with a large somewhat dorsally projecting caudal lobe. Forceps small; in lateral view broad basally, narrowed to apex, curved forward; in caudal view broad and outcurved basally then narrower to truncate apices, a slender laterally projecting black tooth at apex, a smaller one on

medial side. Terminal portion of oedagus greatly enlarged, a slender medial, caudal process near tip. Female genital segment very short; ventral valve very broad, not at all produced, medially excavate; dorsal valve narrow, overhanging, blunt.

Described from 14 males and females from the Okefenokee Swamp, Georgia, three males and one female from northern Florida and one male from Shallotte, N. C. The Ga. and Fla. specimens were taken while sweeping grass and other low vegetation amongst scattered pines, it was impossible to determine the host plant. The females previously described as belonging to this species are found to represent a different, undescribed species.

Type, male, no. 660 U. S. N. M. Baldwin, Florida, March 11, 1879, E. A. Schwarz. **Allotype**, female, Fargo, Ga. Aug. 1, 1939, L. D. Tuthill in author's collection.

Type examined.

Rhinopsylla arcuata n. sp.

1938 **Rhinopsylla schwarzi** Tuthill, Ent. News XLIX:244.

Length to tip of folded wings 3.25 mm.

Color: General color red. Distal portions of tibiae, tarsi, segments III, IV and V of antennae, white. Distal portion of antennae black. Wings hyaline.

Structure: Head short, two and one-half times as wide as long. Deeply cleft in front (not as deeply as in **schwarzii**). Vertex somewhat rounded down in front, with a pair of prominent discal foveae. Eyes protruding, lateral. Genae somewhat swollen ventrally. Antennae two and one-half times as long as width of head, segment III strongly thickened. Thorax broad, somewhat arched. Pronotum broader than vertex. Prothoracic episterna produced. Forewings acutely angled, over two and one-half times as long as wide, costal margin strongly curved; Rs very short, arched to costal margin; marginal cells about equal in size. Prothoracic femora long, scarcely swollen. Hind tibia with small basal tubercle, two inner and one outer apical spines.

Genitalia: Female genital segment short. Ventral valve about one-half as long as preceding sternite, broad, notched apically. Dorsal valve exceeding ventral, narrow, down-curved, blunt.

Described from two females bearing the data, Ponce de Leon, Florida, July 13, 1934 R. H. Beamer. These specimens were erroneously designated (l. c.) as the female of **R. schwarzii** Riley. This species is quite distinct from **schwarzii**, especially in head characters, the anteriorly produced portions of the head are less pronounced and the eyes are lateral rather than anterior. Also the prothoracic femora are much less enlarged, Rs is shorter and more strongly

arched. One additional female from the Okefenokee Swamp, Georgia, seems to be the same but as it is a poor specimen it is impossible to say with certainty.

Holotype, female, in Snow Collection, University of Kansas. Paratype in author's collection.

Rhinopsylla athenae Crawford

1914 **Rhinopsylla athenae** Crawford, U S N.M. Bull. 85:60.

Length to tip of folded wings 3.5 mm.

Crawford described this species as follows:

"Length of body 1.9 mm; length of forewing 3; width of head 0.72. General color deep shining black on head, pronotum, and praescutum; rest of body flavous orange; antennae black, except IV and V and tip of III white; male genitalia a little darker than rest of abdomen.

"Somewhat similar to **schwarzii**, but head not so strongly birostrate, not so deeply cleft, not as broad as thorax; eyes hemispherical and directed somewhat forward (as in **schwarzii** also), but not giving the appearance of being stalked; antennae somewhat similar, but third joint less swollen.

"Thorax scarcely arched; pronotum rather long; praescutum small. Legs very long; forefemora larger than the second pair, but not so conspicuously enlarged as in **schwarzii**; tibiae much longer than femora. Wings narrow, three times as long as broad, narrowly angulate at apex, venation rather similar.

"**Genitalia—Male.**—Anal valve rather small, broad in caudal view, somewhat extended caudad in lateral view; forceps small, cultrate, inner edge rather sharp, only a little arched."

One specimen in the University of Kansas collection (Greenwood Co., Kansas, Aug. 2, 1923 Beamer-Lawson) appears to be this species. I add a few additional notes from it: Vertex rounded down anteriorly and posteriorly. Pronotum narrow, "collar-like." Rs rather long and straight. Hind tibia with small basal spur. Metacoxa with anteriorly projecting processes.

Type, male, Athens Georgia, June 15, 1909 (J. C. Bradley). Type in the collecteion of Cornell University (fide Crawford).

Rhinopsylla antennata (Crawford)

1910 **Paratrioza antennata** Crawford, Pom. Coll. Jour. Ent. II:229.
1911 **Rhinopsylla antennata** Crawford, Pom. Coll. Jour. Ent. III:441.
1911 **Rhinopsylla antennata proxima** Crawford, Pom. Coll. Jour. Ent. III:441-442.
1914 **Rhinopsylla antennata** Crawford, U.S.N.M. Bull. 85:61.
1914 **Rhinopsylla antennata proxima** Crawford, U.S.N.M. Bull. 85:62.
1938 **Rhinopsylla dimorpha** Caldwell, Ohio Biol. Surv. Bull. 34:246.

Length to tip of folded wings 3-3.5 mm.

Color: Male, general color black, abdominal venter, tibiae, tarsi segments III, IV, and V of antennae, white to yellow. Female, general color red, segments III, IV, and V of antennae white, apices black. Considerable variation, as presence of light areas on vertex or thorax, lighter legs, dark abdomen, etc.

Structure: Head stout, slightly over twice as wide as long, cleft anteriorly. Vertex somewhat rounded down anteriorly, a more or less prominent oblique discal sulcus on each side, extending toward base of antenna. Eyes lateral. Genae swollen ventrally. Segments III and IV of antennae thickened. Antennae slightly less than three times as long as width of head. Thorax slightly arched. Pronotum broader than vertex. Prothoracic episterna strongly produced. Forewings angulate, almost three times as long as broad; costal margin arcuate; Rs long (often attaining furcation of media), more or less sinuate; marginal cells about equal. Forefemora enlarged, short. Hind tibia with small basal spur, two inner apical spines. Metacoxa with anteriorly projecting processes.

Genitalia: Male proctiger short, with a blunt triangular caudal lobe. Forceps shorter than protiger; in lateral view broad basally, evenly narrowed to apices, strongly curved cephalad; in caudal view slightly arched, tapered from base to truncate apices, apices with stout lateral and medial processes, appearing somewhat T shaped. Female genital segment short; ventral valve as long as preceding sternite, broad, scarcely produced; dorsal valve exceeding ventral, narrow, overhanging, apex dark, blunt.

Described from numerous specimens from the following localities: Colorado, Utah, Oklahoma, Texas, Ohio. The specimens at hand show considerable variation, especially in color and in wing characters, even in the specimens collected together. Two male spcimens are at hand from Brownsville, Texas which are quite small and have the color of the typical females but structurally they are indistinguishable from typical males.

Crawford's variety **proxima** is merely the female of this somewhat dimorphic species. His description of the male genitalia was very superficial, but upon closer examination of the types they prove to be identical with male paratypes of **dimorpha** Caldwell. The later name therefore must be sunk in synonymy. Caldwell collected his specimens on **Polygonum persicaria** L.

Type, male, Colorado, no. 18082, U. S. N. M.

Type examined.

VOL. 15 JOURNAL KANS. ENT. SOC., APRIL, 1942 NO. 2

DESCRIPTIONS AND RECORDS OF DISTRIBUTION OF PHYLLOPHAGA* (COLEOPTERA: SCARABAEIDAE)

MILTON W. SANDERSON, University of Arkansas

Seven species of Phyllophaga, which occur in the United States, are discussed in this paper. Two of these species, one from Arkansas and other middle west and southeastern states, and the other from Arizona and Mexico, are described as new. A new name is proposed for one species whose present name is preoccupied. Four records of species new to the United States are presented.

The following name is proposed for a locally abundant species of Phyllophaga which has a wide distribution and a wide range of plants upon which the adults are known to feed. Although only two records have been taken for western Arkansas, it is known to occur abundantly in eastern Oklahoma.

Phyllophaga sylvatica n. sp.

This species is closely related to **corrosa** Lec. and **luctuosa** Horn, and appears to occupy an intermediate position between the two. The body varies from reddish-brown to nearly black, and is shining and glabrous above except for some extremely minute hairs which arise from punctures on the disc of pronotum and elytra.

Length 16-20 mm.; width 8.5-10.5 mm.

MALE. **Antenna** 10-segmented, club equal to about three-fourths length of stem. Clypeus deeply emarginate, margin slightly reflexed; surface coarsely and closely punctured, punctures slightly more distant than those on front; clypeal suture impressed. **Pronotum** coarsely and unevenly punctured, punctures separated from one-half of several times their own diameters especially near center of disc; lateral margin of pronotum parallel in basal one-half, coarsely crenate from base to apex. **Hind leg**—Fixed spur of hind tibia subequal to width of this tibia at apex, nearly as long as free spur, curved and pointed; slight emargination at base; free spur widest at middle, bluntly rounded at apex, slightly longer than first tarsal segment. Tooth of claw strong and median. **Metasternum** finely, evenly and closely punctured, punctures especially at sides scarcely separated by their own diameters; hairs erect and about equal in length to greatest width of middle femora. **Elytra** widest behind middle, very finely and shallowly punctured in marginal two-thirds; sutural one-third irregularly rugose; sutural costa distinct, the discal scarcely discernible; marginal costa evident.

*Research Paper No. 727, Journal Series, University of Arkansas, published with the approval of the Director of the Arkansas Agricultural Experiment Station.

Abdomen very finely punctured, less closely in median flattened depression; penultimate sternite in median one-fifth suddenly and almost perpendicularly declivous on posterior two-fifths, apex of delivity coarsely granulate; apical sternite slightly depressed, nearly smooth and with a few small granules in depression; pygidium shining, glabrous, evenly convex, finely and irregularly punctured.

FEMALE. Slightly broader than male and resembling it closely in general sculpture. Club of antenna equal to funicle. Abdomen convex and extremely finely punctured; last abdominal sternite with a deep U-shaped depression at middle of disc behind a deep and wide emargination, emargination partially closed by a thin layer of the integument.

Holotype male, allotype female, 3 male and 11 female paratypes, Sequoyah Co., Oklahoma, April 14, 1939, collected by M. W. Sanderson and J. S. Cook on black jack oak and water oak. Numerous additional paratypes from the same locality, April 24, 1940, M. W. Sanderson. Additional designated paratypes as follows: **Arkansas.** Washington Co., April 21, 1939, 1♀, J. S. Cook, at light; Crawford Co., April 21, 1940, 1 ♀, on persimmon, M. W. Sanderson. **Georgia.** Kennesaw Mt. March 31, 1936, 2♂, 1♀, on oak; April 26, 1936, 1♂; May 7, 1936, 1♂, oak; May 10, 1934, 3♂, hackberry; May 14, 1936, 1♂ 1♀, oak; May 17, 1940, 13♂, 25♀, poison oak, red oak, black locust, persimmon, blackberry, chinquapin, bladdernut, hickory, chestnut, oak. May 20, 1936, 2♂, oak; May 25, 1935, 3♂. Thomaston, March 27, 1938, 5♂, at light. Head River, June 8, 1937, 1♂. Covington, May 16, 1940, 1♂, red oak. Prattsburg, April 15, 1940, 3♂, 5♀, water oak, red oak, wild plum, at light; April 23, 1938, 2♀, red oak, and 1♂, 1♀, oak; April 27, 1938, 7♂, 14♀, black oak, black jack oak; post oak; May 7, 1940, 3♂, 3♀, winged elm, Crataegus, black oak, black jack oak, water oak, red oak. All Georgia material collected by P. W. Fattig. **Oklahoma.** Wichita National Forest, June 6, 1939, 3♂, 2♀, Kaiser—Nailon. **Kentucky.** Adair Co. near Cane Valley, May 22, 1939, 20♂, 21♀, P. O. Ritcher, persimmon, hickory, blackberry. **Kansas.** Kans. Coll. of F. A. Eddy, 2♂, 1♀; Kans. Snow, 1♂; Osage Co., June 14, 1923, W. J. Brown, 1♂, **Nebraska.** May 13, 1♂, H. Pollard.

Types and paratypes in the collection of the University of Arkansas. Additional paratypes in the collections of the U. S. National Museum, University of Kansas, Oklahoma A. and M. College, Ohio State University, Harvard College, the collections of Philip Luginbill, L. W. Saylor, P. W. Fattig, O. L. Cartwright, J. H. Reinhard, C. A. Frost, P. O. Ritcher, and Mark Robinson.

Possibly many of the published records of **corrosa** Lec. actually

refer to **sylvatica.** The most important difference between the two species is in the right clasper of the male genitalia (fig. 8) The ventral abdominal characters and the pubic processes of the females are very similar.

Phyllophaga inopia n. sp.

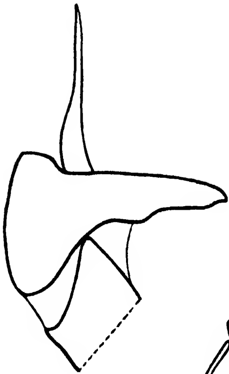
The present species superficially resembles **latidens** Schffr. in size, color, and general appearance. Its body is nearly parallel, light reddish yellow, and the pronotum is distinctly more red than the elytra. The dorsum, except the head, is glabrous and shining.

Length 13-16 mm.; width 6-7.5 mm.

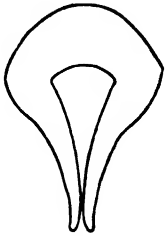
MALE. **Antenna** 10-segmented, club equal in length to funicle. **Clypeus** deeply emarginate, front margin slightly reflexed; surface of clypeus and front coarsely, confluently and confusedly punctured, each puncture with an erect hair; suture impressed; clypeus constricted at base. **Pronotum** twice as wide as long, strongly angulate at sides; base slightly wider than apex; finely and unevenly punctured, space between punctures averaging three or four times their own diameters; front and lateral margins with long hairs some of which are two-thirds length of pronotum. **Hind leg.** Both spurs of hind tibia free, slender, inner spur about three-fourths length of outer; outer spur reaching to basal third of second tarsal segment. Tooth of claw strong, nearly parallel sided in basal two-thirds. **Metasternum** finely and closely punctured, each puncture with long hair of which some are longer than greatest width of middle femur. **Elytra** finely and evenly punctured, punctures separated from once to twice their diameters; sutural, discal and marginal costae obliterated. **Abdomen** convex, slightly impressed at middle, finely punctured on disc, penultimate sternite coarsely punctured on either side of middle to pleural suture, apical sternite three-fourths length of penultimate, coarsely punctured, each puncture with long hair; hind margin of apical sternite with slight emargination; pygidium glabrous, shining, finely punctured, punctures not as closely placed as on disc of elytra.

FEMALE. Distinctly wider behind than male. Club of antenna equal to preceding five segments combined. Penultimate and apical abdominal sternites evenly rounded, punctured as in male, not otherwise modified. Pygidium flattened, evenly punctured, and without tumidity at apex. Tibial spurs closely similar to those of male.

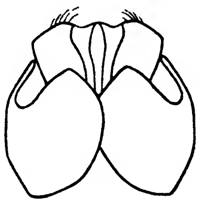
Holotype male, allotype female, Chiricahua Mts., Arizona, July 4, 1940, L. J. Lipovsky, D. E. Hardy, collectors. Additional designated paratypes as follows: 4♂, 7♀, same date, R. H. Beamer, R. C. Kuitert; 3♂, 1♀, same locality, July 13, 1938, R. H. Beamer; 2♂, same locality, April 7, Hubbard and Schwartz, one of which bears the



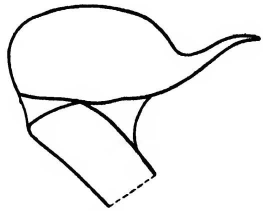
1 P INOPIA



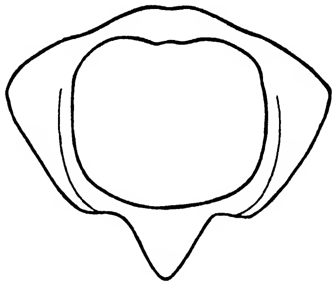
2 P INOPIA



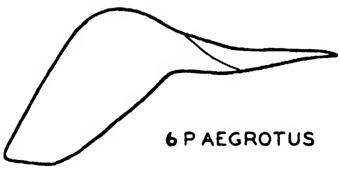
3. P INOPIA



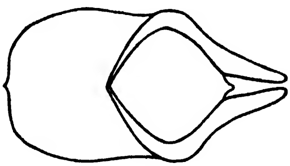
4 P RAVIDA GUATEMALICA



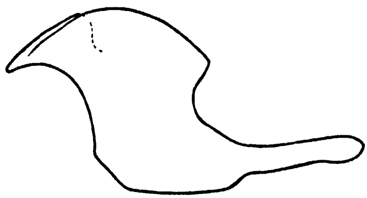
5. P RAVIDA GUATEMALICA



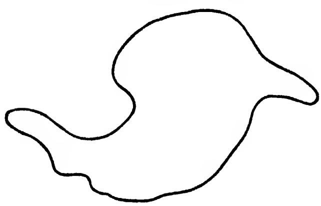
6 P AEGROTUS



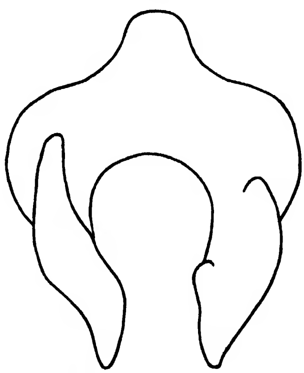
7 P AEGROTUS



8. P SYLVATICA



9 P SYLVATICA



10. P. SYLVATICA

number 1393; 1♂, Huachuca Mts., Arizona, July 18, 1938, R. H. Beamer; 1♂ Cusihuirachic, Chiricahua, Mexico. Types and paratypes located in the F. H. Snow Collection, University of Kansas. Additional paratypes in the collections of the U. S. National Museum, L. W. Saylor, and the University of Arkansas.

In addition to differences in the genitalia, males of this species may be separated from males of **latidens** Schffr. by the more deeply emarginate clypeus, entirely glabrous and punctured surface of the elytra, the shorter and more inclined ultimate abdominal sternite. The female does not have the apex of pygidium tumid as in the female of **latidens.**

Phyllophaga incuria, new name

Listrochelus texanus Lec. 1856. Jour. Ac. N. S. Phila. (2) III, p. 263.
Phyllophaga texana Sand. 1937. Jour. Kans. Ent. Soc. 10, p. 16.

Lawrence W. Saylor has recently united Listrochelus (1940) with Phyllophaga as a subgenus which now necessitates the proposal of a new name for **Phyllophaga texana** Sand. The name **texanus** had been previously used by LeConte in Listrochelus. His species is now considered a synonym of **mucorea** LeConte.

Phyllophaga ravida guatemalica Moser

Phyllophaga ravida guatemalica Moser. 1918. Stett. Ent. Zeit. 79, p. 24.

One male of this species was collected at Laredo, Texas, June 5, 1932, by C. E. White, and was determined by Lawrence W. Saylor. This is the first record of the species in the United States. It is closely related to **heterodoxa** Horn and **dentex** Bates from Arizona. The club of the antenna is shorter than the stem, and the pygidium is impunctate and virtually glabrous. From **dentex** it differs further by the short median tooth of the hind tarsal claw. This tooth is only one-half the length of the apical tooth. The genitalia are figured on plate I. Specimen located in the F. H. Snow Collection, University of Kansas.

EXPLANATION OF PLATE

1. Phyllophaga mopia n. sp., left lateral view of male clasper
2. Phyllophaga mopia n. sp., caudal view of clasper
3. Phyllophaga mopia n. sp. pubic process of female.
4. Phyllophaga ravida guatemalica Moser, left lateral view of male clasper.
5. Phyllophaga ravida guatemalica Moser, caudal view of clasper.
6. Phyllophaga aegrotus Bates, left lateral view of male clasper.
7. Phyllophaga aegrotus Bates, caudal view of clasper.
8. Phyllophaga sylvatica n. sp., right lateral view of male clasper.
9. Phyllophaga sylvatica n. sp., left lateral view of clasper.
10. Phyllophaga sylvatica n. sp., caudal view of clasper.

Phyllophaga gravidula Moser

Lachnosterna gravidula Moser. 1921. D. Ent. Zeit., p. 247.
Phyllophaga perita Sand. 1937. Jour. Kans. Ent. Soc. 10: p. 14-15.

I have been informed of the synonymy above by Lawrence W. Saylor. He possesses a cotpye of **gravidula** and also a specimen determined for him by Moser. Recently I have examined two males and two females of this species in the Ohio State collection from Patagonia Mts., Arizona. They were collected by D. J. and J. N. Knull one evening, July 20, 1940, in an oak-acacia association.

Phyllophaga onchophora Chapin

Phyllophaga onchophora Chapin. 1932. Ann. Ent. Soc. Amer. 25, p. 184.

One male, Savannah, Georgia, May 2, 1929, P. W. Fattig. This species originally was described from Cuba and may have accidentally entered the United States. Professor Fattig has collected many species and many thousands of Phyllophaga in Georgia, but informs me that this is the only representative of this species he has taken. Collected at light.

Phyllophaga (Phytalus) aegrotus Bates

Lachnosterna aegrotus Bates. 1888. Biol. Centr. Amer. II, 2, p. 182.

One male, Laredo, Texas, June 5, 1932, C. E. White. This species is an addition to the Phyllophaga fauna of the United States. In Saylor's revision of the subgenus Phytalus, (1939), this species traces in his key to the vicinity of **bilobatata** Saylor. However, **aegrotus** differs much from this larger species and is here briefly described.

Length 10.5 mm.; width 5 mm.

MALE. Color light yellow above, disc of head and pronotum brown. **Head** and clypeus strongly punctured, each puncture with a long erect hair; margin of clypeus rather strongly reflexed. Antenna 9-segmented. **Pronotum** glabrous on disc, punctures fine, not closely placed and irregularly distributed; sides subparallell in basal one-half. **Elytra** glabrous, finely and evenly punctured; sutural costa distinct, discal and marginal ones entirely obliterated. **Hind leg.** Both spurs of hind tibia free and slender. All femora with long hairs. Lower tooth of claw shorter than upper and subtruncate at apex. **Abdomen** flattened on disc, finely punctured and with a few short hairs, otherwise unmodified; pygidium glabrous, finely and shallowly punctured, slightly tumid at middle of disc; basal half with a fine, longitudinal, impressed line. The genitalia are figured on plate I. Specimen located in the F. H. Snow Collection, University of Kansas.

LITERATURE CITED

Saylor, L. W. 1939. Revision of the beetles of the Melolonthine subgenus Phytalus of the United States Proc. U. S Nat. Mus. 86, p. 157-167

———. 1940. Revision of the scarabaeid beetles of the Phyllophagan subgenus Listrochelus of the United States, with discussion of related subgenera. Proc. U. S. Nat. Mus. 89, p. 59-60.

A NEW SPECIES OF DORYCEPHALUS (HOMOPTERA CICADELLIDAE)

R. H. BEAMER*

Dorycephalus brevis n. sp.

Resembling **D. delongi** Knull, but much shorter; vertex shorter, but slightly longer than pronotum and elytra; male pygofer short, about as long as four preceding segments of abdomen. Length, male 8 mm., female 10-13 mm.

Vertex highly arched, much more than in **delongi**, appearing as a raised portion with a sharp median carina. Elytra short, about as in **delongi**, but with apex more rounded. Pygofer of female about half as long as distance from its base to apex of elytra, in male almost as long as that distance.

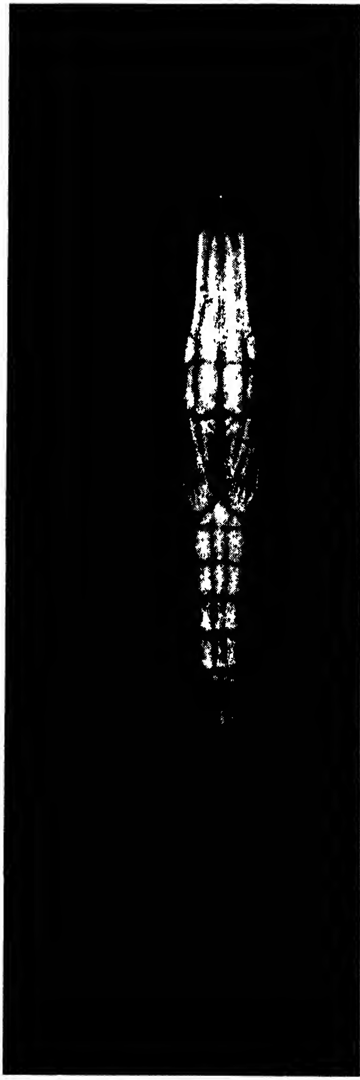
Genitalia: Last ventral segment of female with posterior margin about as in **delongi**, with large median projection and notch either side; distance from tip of last ventral segment to opening of ventral margin of pygofers slightly more than three times as long as from there to apex. Last ventral segment of male shorter than preceeding, with posterior margin slightly concave; valve broadly rounded and barely exposed; plates narrowed almost twice as long as last ventral segment; pygofers about half as long as remainder of the abdomen, ventral margins diverging just beyond apex of plates.

Holotype male, allotype female, paratypes as follows: 20 females and 22 males, Vaughn, New Mexico, June 5, 1933, R. H. Beamer; 26 females and 12 males, Silver City, New Mexico, July 23, 1936, R. H. Beamer. Types in the Snow Entomological Collections.

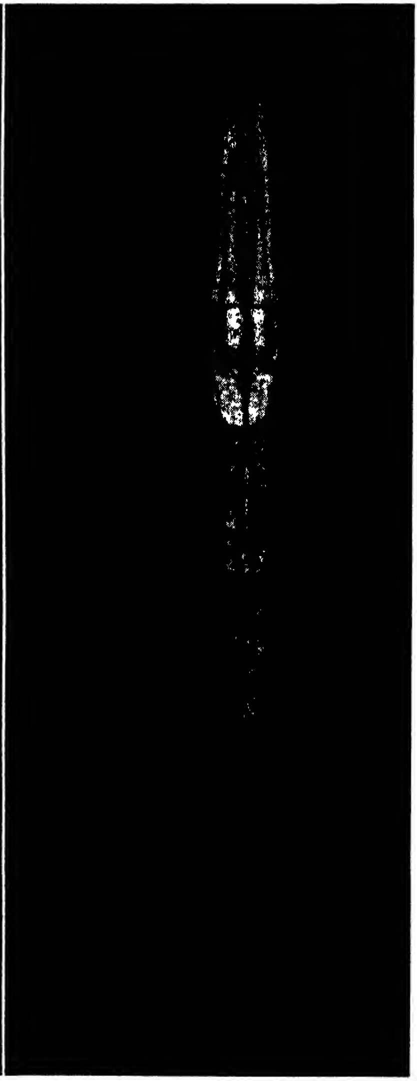
This species was collected in an awn grass by cutting off the

*Contribution from the Department of Entomology, University of Kansas.

bunches of grass and shaking them out in a net. They live very close to the roots of the plant and are only occasionally taken by sweeping.



D. brevis ♂



D. delongi ♂

NEW WESTERN ASILIDAE

D ELMO HARDY, Lawrence, Kansas*

Stenopogon huachucanus n. sp.
(fig. 2a)

This species is related to S. **kelloggi** Wilcox but is distinguished by its larger size, longer wings, more sparsely bristled thorax, femora blackened dorsally, differences in wing venation as discussed in the description, female abdomen blackish toward apex and sides and venter darker. The male hypopygia are very different (compare figs. 1a and 2a).

Male.—All bristles and hairs yellow-white to slightly reddish. **Head:** First two antennal segments yellowish red, third segment and arista black. Third rather short, not quite one-fourth longer than first two segments; arista slender and bristlelike, almost half as long as third antennal segment. Proboscis shining black, palpi brownish. Vestiture of front straw yellow, that of face more whitish while that of occiput and vertex is reddish. **Thorax:** Brownish black in ground color, chiefly yellow-gray pollinose with two faint brownish vittae running longitudinally down the dorsum, the median yellow-gray line separating these is more distinct than in **kelloggi**. Sternopleurae each with a thin patch of long hairs near upper portions, hypopleurae with fine hairs. Bristles of dorsum largely confined to the margins with no strong dorsocentrals in front of the transverse suture; dorsum in front of suture covered with short, somewhat appressed brown hairs. The hind portion of the thorax is much more densely bristled in **kelloggi**, the strong dorsocentral bristles extend in front of the transverse suture and the hair on the frontal portion is more elongate, yellowish and erect. Humeri reddish, halteres yellow. **Legs:** Chiefly yellow-red, coxae blackish with a rufous tinge, dorsal portions of femora blackened. Bases of tarsal claws yellow, apical three-fourths black. **Wings:** Faintly iridescent, veins brown except at extreme wing bases, where they are yellowish. Costa with dense yellow hair on basal portion. Crossvein r-m situated just before middle of distal cell instead of at basal half as in **kelloggi** and near the middle of vein R_{4+5}. Petiole of first posterior cell rather short, about equal to length of r-m crossvein. Petiole of fourth posterior cell just slightly longer than r-m crossvein. Crossvein m less than one-third the length of M_3 before the crossvein, instead of more than half its length as in **kelloggi**. Cubital cell just barely closed in the wing margin. **Abdomen:** Yellow-red, base of first tergum, lateral margins and narrow bases of second

*Contribution from the Department of Entomology, University of Kansas.

terga blackish. Hairs and bristles of abdomen reddish. Hypopygium yellowish red, somewhat more shining than the abdominal terga The ninth tergum is deeply cleft and similar to **kelloggi** except that the apices are more broad and rather acutely pointed on inner margins. The plate beneath the coxopodite is densely haired, rather square topped on posterior margin with a 'V' shaped concavity in middle portion, instead of the entire hind margin being broadly 'V' shaped as in **kelloggi**. The coxopodite is modified into a pair of large lateral lobes, these are broad and somewhat rounding apically each with a small hairy lobe on outer margin and with a long fingerlike lobe extending to about the middle line on inner margin. The clasping structures are long, narrow and tapered slightly at apices (fig. 2a). The aedeagus is much more narrow than in **kelloggi**.

Length: body, 16-17 mm.; wing, 8.8-9.3 mm.

Female.—Apex of abdomen blackish, sides and venter of abdomen discolored with black. Apical spines reddish. Bristles almost entirely white, hairs more consistently whitish. Otherwise like the male.

Holotype male, Huachuca Mts., Arizona, July 18, 1938 (Jean Russell). Allotype female and two paratypes, one male, one female, same locality and date (R. H. Beamer, Jean Russell). All in Snow Entomological Collection.

The pictipes complex of the genus Leptogaster

The pictipes complex includes those Leptogaster, exclusive of the subgenus Psilonyx (those having no empodia), having the fourth posterior cell (M_3) sessile or nearly so at its base, the base of vein M_2 sharply bent forming a distinct angle with the m crossvein and the base of M_2 equal or shorter than m crossvein (fig. 3a); instead of the fourth posterior cell being petiolate at base or M_2 being straight for its entire length, the basal portion not distinctly bent. **Leptogaster brevicornis** Loew has the fourth posterior cell sessile but vein M_2 is straight, the basal portion is usually twice the length of m crossvein and the third antennal segment is ovate and shorter than its style. The mystax of **brevicornis** is made up of many closely set bristles while in the known species of the pictipes group it is composed of a few pairs of distinctly spaced bristles.

Key to species based upon males

1. Lobes of ninth tergum bifid at apices (figs. 3b, c) __**bifidus** n. sp.
   Lobes not as above ______________________________________2

2. Lobes of tergum long and slender, acutely pointed at apices (figs. 4a, b) ____________________________ **floridensis** Johnson

Lobes not greatly elongated, rather thick and square topped at apices -- 3

3\. Plates above cerci short, two times as wide as their greatest width (fig. 6b) ----------------------------**pictipes** Loew

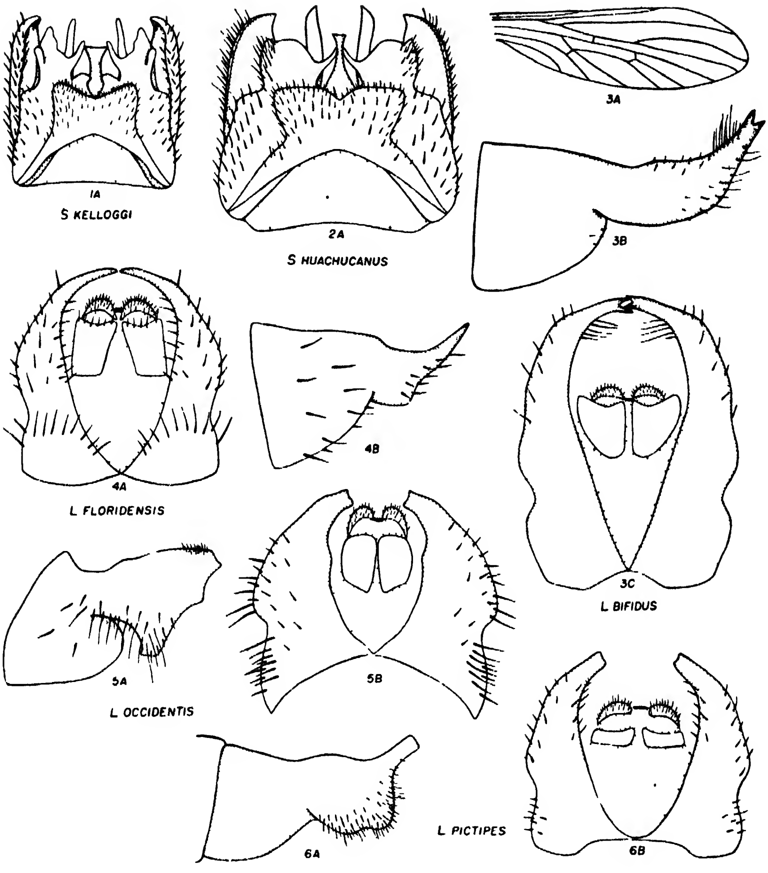
Plates above cerci much longer than wide (fig. 5b)------ -- **occidentis** n. sp.

Leptogaster bifidus n. sp.
(fig. 3a-c)

This species is related to **pictipes** Loew but the male genitalia are strikingly different. They are most easily distinguished by the elongate, apically forked lobes of the ninth tergum.

Male.—Head: Mystax composed of four to six long white bristles. Face grayish pubescent with a subshining black stripe down the middle. First two antennal segments yellow; third largely black, with broad yellow base. Third antennal segment rather elongate, about one-fourth longer than first two segments; style long and slender, about equal to or but slightly longer than third segment. Pubescence and bristles of occiput white. **Thorax:** Black in ground color, silvery gray pubescent on the sides and grayish brown on the dorsum, with two very faint gray, longitudinal vittae. The pair of presutural bristles are yellow and supra-alars are black with the bases slightly yellowed. Humeri faintly tinged with yellow. Halteres yellow with the knobs slightly discolored. **Legs:** Chiefly yellow. Hind femora rather strongly swollen on apical portions, hind tibiae slightly so. Posterior femora and tibiae each with a pair of brownish to black rings, the apices of the tibiae are broadly banded while the femora are narrowly so; the tibiae possess a broad band near the median portions while the corresponding bands of the hind femora are at about the apical one-third. Front two pairs of legs entirely yellow, tarsal claws black; posterior tarsi yellowish brown. Empodium present. The wing venation (fig. 3a) is identical with **pictipes**. **Abdomen:** Subshining brownish black in ground color, lightly gray pruinose; apices of segments two to five narrowly yellow. Apical portion of abdomen swollen and more blackish. **Hypopygium:** Lobes of ninth tergum large and well developed, extending about as long as last two abdominal segments, these lobes are bifid at their apices (fig. 3b, c).

Female.—The gray vittae of the mesonotum are more distinct and the pleurae more densely pubescent, otherwise like the male except for genital characters. The females are not separable from those of **floridensis** Johnson except when accompanied by males or upon geographic distribution; the first two antennal segments are



EXPLANATION OF FIGURES

Fig. 1. **Stenopogon kelloggi** Wilcox, a. male hypopygium, ventral view with anal region and cerci dissected off.

Fig. 2. **S. huachucanus** n sp a. ventral of hypopygium without anal region or cerci.

Fig. 3. **Leptogaster bifidus** n. sp. a. wing. b. ninth tergum of male, lateral c male hypopygium, dorsal.

Fig. 4. **L. floridensis** Johnson, a. male hypopygium, dorsal. b. ninth tergum of male, lateral.

Fig. 5. **L. occidentis** n. sp., a ninth tergum, lateral. b. hypopygium, dorsal.

Fig. 6. **L. pictipes** Loew, a. ninth tergum, lateral. b. hypopygium, dorsal.

more consistently yellowed and the gray vittae of the dorsum more distinct.

Holotype male, Ruby, Arizona, July 13, 1940 (R. H. Beamer). Allotype female and eighteen paratypes, ten males and eight females: same locality, July 22, 1938-July 13, 1940 (R. H. Beamer, D. E. Hardy); Santa Rita Mts., Ariz. VIII-1-41 (R. H. Beamer, L. H. Banker and B. Hodgden); Huachuca Mts., Ariz. VII-30-41 (R. H. Beamer) and Arivaca, Ariz. VII-26-41 (E. L. Todd) All in Snow Entomological Collection.

Leptogaster occidentis n. sp.

(figs. 5a-b)

This species is best distinguished from **pictipes** Loew by genital characters. It is most easily separated by the elongated plates above the cerci and the strong development of the lower portion of the plates of the ninth tergum as seen from lateral view.

Male.—Fitting for the most part the description of **bifidus** n. sp., the presutural bristles, however, are black; the humeri are black and the knobs of halteres more brownish, the posterior femora are not so strongly swollen and the leg coloration is different. The dilated portion of the hind femora is almost entirely black with only a narrow yellow band separating it from the apical band. The apical halves of the hind tibiae are brownish black, the last four subsegments of the tarsi are brownish and the tibiae are more thickly covered with white pile. The apical portion of the abdomen and the genitalia are thickly white pilose. **Hypopygium:** Polished brown to black. Plates of ninth tergum broad and square tipped, extending about the length of the last abdominal segment. From lateral view the lower margin of each plate is rather strongly produced and has a deep indentation at about the median portion (fig. 5a). Plates above cerci decidedly longer than wide (fig. 5b).

The females cannot be distinguished conveniently from those of **pictipes** unless accompanied by the male.

Holotype male, Chiricahua Mts., Arizona, July 4, 1940 (D. E. Hardy). Allotype female, Sunnyside Canyon, Huachuca Mts., Arizona, July 9, 1940 (R. H. Beamer). Nine paratypes, five males, four females, from following localities: Same data as holotype; same locality as allotype (R. H. Beamer, L. C. Kuitert, R. I. Sailer, D. E. Hardy); Mountain Park, New Mexico, June 27, 1940 (R. H. Beamer, D. E. Hardy), and Santa Rita, Mts., Arizona, July 19, 1938 (R. I. Sailer). All in Snow Entomological Collection.

CONCERNING TRICHOCORIXELLA JACZEWSKI (HEMIPTERA-CORIXIDAE)

H. B. HUNGERFORD, Lawrence, Kansas*

Trichocorixella Jacz., 1931

T. Jaczewski, 1931. Annales Musei Zoologici Polonici. IX., Nr. 15, pp. 217-218.

In his studies on Mexican Corixidae, Dr. Jaczewski established the genus **Trichocorixella** for a species which he named **T. wolskii.** He had before him 3 males and 15 females. The males were sinstral and the series was from Mexico, D. F., Chapultepec. I had described previously (1927) under the name **Palmacorixa mexicana** a species from a single pair of specimens from Xochimilco Sea, Mexico, D. F. The solitary male was dextral. Since that time I have examined the following.

3 specimens "Mexico, D. F., April 22-25, 1910." 2 of them males, 1 sinstral, 1 dextral.

13 specimens "Tres Cumbres, Morelos, 70 kil. south of Mexico City, Oct. 1, 1938. H. D. Thomas." 7 of them males, 3 sinstral, 4 dextral.

27 specimens "Mexico, D. F., Xochimilco, June 21, 1934. H. Hinton." 11 of them males, 4 sinstral, 7 dextral.

13 specimens "Mexico, Puebla, Puebla, July 24, 1937. H. D. Thomas." 3 of them males, 1 sinstral, 2 dextral.

34 specimens "Mexico, Tehuacan, Puebla, July 18-25, 1937. H. D. Thomas." 16 of them males, 8 sinstral, 8 dextral.

84 specimens "Mexico, Chapultepec, D. F., Aug. 10, 1937. H D. Thomas." 21 of them males, 7 sinstral, 14 dextral.

Thus, in a total of 60 males we find 24 sinstral and 36 dextral, and both right and left asymmetry represented in all six lots.

The genus **Trichocorixella** is defined by Dr. Jaczewski as follows:

"Abdominal asymmetry in the males sinistral, genital armature directed leftwards. Strigil present. Front tibiae and palae of males as in **Trichocorixa** Kirk., but the palae with two rows of stridulatory pegs, one of these rows forming the central portion of a row of unmodified bristles. Pattern of the hemelytra of the **Trichocorixa** type, membranal suture not marked by a pale oblique stripe, pale markings of corium being continued over the membrane without any interruption. Generic type **Trichocorixella wolskii** n. sp."

I am convinced that **Trichocorixella wolskii** Jaczewski 1931 is a synonym of **Palmacorixa mexicana** Hungerford 1927 (Pan-Pacific Entomologist, Vol. IV, No. 2, p. 94.)

*Contribution from the Department of Entomology, University of Kansas.

In view of G. Stuart Walley's careful re-description of **Palmacorixa** Abbott (Can, Ent. LXII, pp. 99-106, 1930, I am inclined to consider that **Trichocorixella** Jaczewski is a good genus and, therefore, that **Palmacorixa mexicana** Hungerford should be **Trichocorixella mexicana** (Hungerford).

Moreover, **Trichocorixella** is a genus where there is marked instability in the male asymmetry, a condition seen also in **Krizousacorixa** Hungerford and to a less degree in **Corisella** Lundblad, and the generic diagnosis should be modified since, at present, we know more dextral than sinstral males.

RHOPALIDAE A. & S. FOR CORIZIDAE D. & S. (HEMIPTERA)

H. M HARRIS, Ames, Iowa

Among the older workers there was considerable difference of opinion concerning the rank and the name to be given to this group of bugs. Modern systematists are largely agreed that the group is deserving of family rank but the matter of the proper name for them is still unsettled. In general, European workers have used Rhopalidae (or Rhopalinae) where American workers use Corizidae (or Corizinae). China however, in a recent study of the British species uses the subfamily name Corizinae (Ent. Mo. Mag., 77:273-278, 1941). Essentially the problem hinges upon the rank to be accorded the sub groups,—are they genera or subgenera, what are their type species and what names have priority? Also the old question of what constitutes the type genus of a family is involved.

The oldest generic name in the family is **Coryna**, proposed by J. F. Wolff in 1811 for the **Lygaeus sidae** of Fabricius. This name of Wolff's, along with some other genera proposed in the same work, was overlooked by hemipterists until Schumacher (1922) and McAtee and Malloch (1923) called attention to it. Sherborn lists **Coryna** Wolff as a nomen nudum and later says of it, "name and figure only." McAtee and Malloch have pointed out that Wolff gives a description as well as a figure to which his "No. 187 **Coryna**, Keulenwanze" refers. Sherborn therefore was in error in citing **Coryna** Wolff as a nomen nudum. There is, however, a question of priority. Agassiz lists **Coryna** Gärtner as occurring in Pallas, Elenchus Zoöphytorum, published in 1766. Sherborn states that he was unable to locate the

reference. McAtee and Malloch report that they inspected the work cited in vain and Schulze does not cite the 1766 usage. There is a **Coryne** Gaertner, 1774 (Hydroids). In 1802 Le Bosc used **Coryna** for the **Coryne** of Gaertner. Without having access to Le Bosc's work it had appeared to me that his use of **Coryna** was an error of typography and therefore did not affect Wolff's 1811 usage in the Hemiptera. Were this the case **Coryna** Wolff, haplotype, **Coreus sidae** Fabricius, would have precedence over some later proposed genera and would affect the family name. Mr. H. G. Barber, to whom I am greatly indebted for this as well as for many other favors, has examined Bosc's "Histoire Naturelle des Vers" for me and writes that Bosc's use of **Coryna** actually was an emendation of the French form of the word **Coryne** used by Gaertner. **Coryna** 1802, thus is an objective synonym of **Coryne** 1776 and invalidates Wolff's later use of **Coryna** in a different sense. **Coryna** Wolff therefore is a dead homonym. (For parallel cases see opinions 120 and 125, international Commission Zoological Nomenclature).

The next oldest genus and the oldest valid one in the family is **Corizus** Fallen, 1814 (type, **hyoscyami** L.).

The first name for these insects recognizable as specifically designating a category that ranks greater than the genus is **Rhopalides** of Amyot and Serville (1843). This was followed by **Rhopalidae** Dallas (1852), and **Rhopalidae** Stal (1860). In 1865 Douglas and Scott used **Corizidae** and in 1868 (1866) Mayr, in his Novara Hemiptera, used **Corizida.**

If one is to recognize the oldest valid genus in a family as type genus of that family (vide Kirkaldy and McAtee) the name of the family becomes **Corizidae.** On the other hand, if we follow the other school of thought (Horvath, VanDuzee, and Bradley, also Opinion 133, International Commission Zool. Nomenclature) in the much more logical practice and recognize as type genus of a family the genus whose stem enters into the formation of the earliest proposed category of greater rank than the genus, then the type genus becomes **Rhopalus** Schilling and the family name **Rhopalidae** A. and S. But as stated above the problem is further complicated by the doubt that exists regarding the status of the genera involved. If we rank **Rhopalus** as a subgenus in the older genus **Corizus** the proper family name again becomes **Corizidae** but must be accredited to Douglas and Scott, rather than Mayr as has been the custom of American workers. At the present status of my study of the group it is my opinion that the type species of **Rhopalus** Schilling and the type species of **Corizus** Fallen, namely **R. subrufus** (Gmel.) and **C. hyoscyami** (Linn.) are not congeneric. I would therefore use the family name Rhopalidae.

HOST PLANT RECORDS OF CERCOPIDAE IN NORTH AMERICA, NORTH OF MEXICO (HOMOPTERA)

KATHLEEN C. DOERING, Lawrence, Kansas*

Abstract

An alphabetical list of the recorded host plants of the known species of Cercopidae in North America, North of Mexico is presented. Common names and scientific names for both insects and plants as well as family names are alphabetized. Brief discussions are given of the subterranean feeding habits of certain species and egg deposition of all genera except **Aphrophora.** For eighteen out of the total fifty-six species no host records of any sort have been recorded.

Purpose of the Paper

The primary object of this paper is to give a summary of our present knowledge concerning the relationship between the recognized species of this one family of insects and their plant hosts. In this way it is hoped that interest will be stimulated in the feeding habits of the group and thus new host plant records will be noted. The writer would greatly appreciate any material sent to her. If collectors would take time out while collecting in their own groups to also collect any Cercopid nymphs with adults that they might see and send in a small vial of them, together with all possible data concerning the host plant on which they are feeding, real progress could soon be made toward making the host plant records complete for the entire family.

Feeding Habits

The more usual habits are the feeding of the nymphs on the leaves or stem when the familiar spittle masses are readily seen. There are, however, several species which practice subterranean feeding or else are concealed in some way. **Aphrophora angulata** Ball was found feeding in the enlarged sheath of **Heracleum lanatum** Michx (Ball, 1915). The sheath when broken showed masses of froth and nymphs. **Aphrophora permutata** Uhler feeds at the base of the clumps or often below surface among roots on **Chrysopis villosa** (Pursh.) Nutt and **Lupinus** sp., (Ball, 1901). **Aphrophora annulata** Ball was found on the crown of **Artemisia ludoviciana** Nutt, (Ball, 1915). Froth masses of **Tomaspis bicincta** Say were found in damp clumps of grass and some partly below ground (Ball, 1938). **Philaronia abjecta** (Uhl.) was found on the roots and crowns of **Lupine** and **Geranium** in the mountains of Colorado (Ball, 1915).

*Contribution from the Department of Entomology, University of Kansas.

Egg Deposition

Eggs have been found for all the genera except **Aphrophora** (Garman, 1925). The usual places are either in the dead stems, sheath of growing plant or beneath the bark. Specific observations which have been described are as follows:

Aphrophora salicis DeGeer in Arnold Arboretum in the terminal twigs of willow with 1-2 eggs for each puncture (Metcalf and Barber, 1929).

Clastoptera obtusa Say. In September and October laid in bark of alder frequently behind bud and in July on new growth in slits. (Garman, 1923).

Clastoptera proteus Fitch. Beneath bark on outer twigs and one to three eggs per puncture.

Lepyronia quadrangularis Say. In spring in rotten stems and twigs, (Doering, 1923 and Garman, 1923).

Tomaspis bicincta (Say). Eggs laid on stems of plants in autumn. (Harris).

Philaenus lineatus (Linn.). Female does not thrust her ovipositor through any portion of plant tissue but merely inserts the eggs between stalk and leaf sheath within 2 or 3 inches of ground. There are 2 - 24 eggs in a mass and each mass is surrounded with a white, frothy material that is tough and inelastic. (Barber and Ellis, 1922).

Philaenus leucophthalmus (Linn). Eggs in single rows, 2 - 18 eggs to a mass and covered by a protective material. (Barber and Ellis, 1922).

Philaronia bilineata (Say). Eggs in a single row with five eggs per mass and covered by a protective material. (Barber and Ellis, 1922).

Plant Families Recorded

A total of thirty-eight families of plants are given in the present list. It does not always follow, however, that every plant represented means actual feeding since many adults have been taken while sweeping and this does not mean that a particular plant is necessarily the host plant. Of the thirty-eight families listed, twenty-seven families are represented by only one to three species of plants and eleven families by four or more. The families having the most rcords are Compositae 33, Pinaceae 12, Gramineae 11, Betulaceae 10, Rosaceae 7, Salicaceae 7, and Cornaceae 6.

PLANT BIBLIOGRAPHY

Bailey, L. H. Manual of Cultivated Plants. 1924.
Britton, N. L. and Brown, H. A.

Illustrated Flora of Northern United States, Canada and British Possessions. Vol. I - II - III, Sec. Ed. 1936.
Hitchcock, A. S. Manual of the Grasses of the United States, United States Dept. of Agric. Misc. Pub. 200, 1938.
Jepson, Willis L. A Manual of Flowering Plants of California. 1925.
Rehder, Alfred. Manual of Cultivated Trees and Shrubs.

Host Plants

[4]Names starred means that nymphs have been found feeding on the plant.

Acacia (False). See **Robinia pseudoacacia** L.

Acanthaceae. See
- **Ruellia ciliosa** Pursh.
- **Ruellia parviflora** (Nees) Britton.

Acer sp. Maple sp. See
- **Clastoptera achatina** Germ.
- **Lepyronia quadrangularis** (Say).
- **Philaenus leucophthalmus** Linn.
- **Philaenus lineatus** L.

Aceraceae. See **Acer**, maple sp.

Aesculus L. Horse chestnut. See **Clastoptera obtusa** var. obtusa (Say).

Aesculus parviflora Walt. Horse chestnut. See **Philaenus leucophthalmus** L.

Agrimonia gyrposepala Wallr. See **Lepyronia quadrangularis** (Say).

Agrimony. See **Agrimonia gyrposepala** Wallr.

Alder sp. See **Alnus** sp.

Alder (Hoary). See **Alnus incana** (L) Willd.

Alder (Smooth). See **Alnus rugosa** Spreng.

Alder (Speckled). See **Alnus incana** (L) Willd.

Alder Spittle-bug. See **Clastoptera obtusa** (Say).

Alfalfa. See **Medicago sativa** L.

Alnus sp. Alder. See
- **Clastoptera obtusa** var. **borealis** Ball.
- **Clastoptera obtusa** var. **tristis** Van Duz.

Alnus incana (L) Willd. Speckled or Hoary Alder. See **Clastoptera obtusa** var. **tristis** Van Duz.

Alnus rugosa Spreng. Smooth Alder. See **Clastoptera obtusa** var. **obtusa** (Say).

Alnus serrulata=**Alnus rugosa** Spreng.

Alyssum L. See **Philaenus leucophthalmus**. L.

Ambrosia sp. See **Clastoptera xanthocephala** var. **xanthocephala** Germ.

Ambrosia elatior L. Ragweed, Roman Wormwood, Hogwood, Wild Tansy. See

Clastoptera xanthocephala var. **unicolor** Fowl.
Lepyronia quadrangularis (Say).

Ambrosia trifida L. Horse Cane, Horseweed, Bitterweed, Great Ragweed. See:
Lepyronia quadrangularis (Say).
Clastoptera xanthocephala var. **xanthocephala** Germ.

Amy-root. See **Apocynum cannabinum** L.

Anacardiaceae. See **Rhus glabra** L.

Andropogan furcatus Muhl. See **Lepyronia quadrangularis** (Say).

Anonaceae. See **Asimina triloba** (L.) Dunal.

Anthemis arvensis L. Corn or Field Camomile. See:
Clastoptera xanthocephala var. **xanthocephala** Germ.

***Aphrophora angulata** Ball.
***Heracleum lanatum** Michx. Giant Umbellifera, Cow-Parsnip or Master-wort, (nymphs, Ball); **Salix**, willow (adults, Ball and Van Duzee).

***Aphrophora annulata** Ball.
***Artemisia ludoviciana** Nutt. Dark-leaved Mugwort or Sage, (nymphs, Ball); **Pinus**, pine (adults, Ball).

Aphrophora canadensis Walley.

Aphrophora detritus Walker.

Aphrophora fulva Doering. **Pinus sabiniana** Dougl., digger pine (adults, Beamer).

Aphrophora irrorata Ball. **Pinus**, pine (adults but no nymphs, Ball); **Populus tremuloides** Michx., American Aspen (adult female only, Doering).

Aphrophora maculosa Doering.

***Aphrophora parrallela** (Say). The Pine Spittle-bug. **Pinus banksiana** Lamb. Jack pine or Grey pine of North (adults, Beamer); **Pinus rigida** Mill. Pitch Pine (adults, Smith); ***Pinus strobus** L. Weymouth or White Pine (nymphs, Ball and Fitch); ***Pinus sylvestris** L. Scotch or Scots Pine (nymphs, Ball and Fitch); **Tsuga canadensis** Carr., Hemlock (adults, Van Duz.).

***Aphrophora permutata** Uhler.
***Chrysopsis villosa** (Pursh.) Nutt., Hairy Golden Aster (nymphs at base of clumps and on roots, Ball); ***Lupinus** sp. (nymphs at base of clumps and on roots, always near pines, Ball); **Pinus**, pine sp. (adults, Ball); *many weeds (nymphs and adults, Beamer); ***Sambucus callicarpus** Greene (nymphs and adults, causing contortion of leaflets, National Museum data).

Aphrophora princeps Walley.

Aphrophora punctipes Walley.

*Aphrophora salicis De Geer. *Salix nigra Marsh., Black Willow; *Salix petiolaris Smith and many species of willow (in Arnold Arboretum, nymphs, Metcalf and Bruner).

*Aphrophora saratogensis (Fitch). *Ferns, always beneath pines (nymphs, Ball); Larix laricina (Du Roi) Koch., American Larch or Tamarack (adults, Beamer); Pinus banksiana Lamb., Jack Pine (adults, Beamer); Pinus rigida Mill., Pitch pine (adults, Fitch); Pinus strobus L., Weymouth or White pine (adults, Fitch).

*Aphrophora signoreti Fitch. Pinus, pine (adults, Ball); *Vitis sp. grape (nymphs, Ball, Fitch).

*Aphrophora quadrinotata Say. The Grape Spittle-bug. Grass and low vegetation (nymphs, Ball); Vernonia interior=Vernonia Baldwinii Torr, Baldwin's Ironweed (nymphs, Schwitzgebel).

Aplopappus acradensius. See Clastoptera lineatocollis Stal.

Apocynaceae. See
Apocynum cannabinum L.
Apocynum pubescens R. Br.

Apocynum cannabium L. Indian Hemp, Amy-root, Dogbane. See Lepyronia quadrangularis (Say).

Apocynum pubescens R. Br. Velvet Dog-bane. See Lepyronia quadrangularis (Say).

Arbor-vitae. See Thuja occidentalis L.

Arctostaphylos uva-ursi Spreng. Bearberry. See Clastoptera saint-cyri var. anceps McAtee

Aronia Pers. Chokeberry. See Philaenus leucophthalmus L.

Artemisia dracunculoides Pursh. Linear-leaved Wormwood. See Clastoptera lineatocollis Stal.

Artemisia ludoviciana Nutt. See Aphrophora annulata Ball.

Artemisia tridentata Nutt. Sagebrush. See
Clastoptera binotata Ball, Clastoptera brunnea Ball,
Clastoptera delicata Uhl., Clastoptera lineatocollis Stal.

Ascelepiadaceae. See
Ascelpias syriaca L.
Ascelpias tuberosa L.
Ascelpias verticillata L.

Asclepias syriaca L. Common Milkweed. See
Lepyronia quadrangularis (Say).

Asclepias tuberosa L. Butterfly Weed or Pleurisy Root. See
Lepyronia quadrangularis (Say).

Asclepias verticillata L. Whorled Milkweed. See
Lepyronia quadrangularis (Say).

Asimina triloba (L) Dunal. North American Papaw. See
Clastoptera obtusa var. obtusa (Say),

Chrysothamnus graveolans Greene. Rabbit Brush. See **Clastoptera brunnea** Ball, **Clastoptera delicata** Uhl.

Chrysothamnus nauseolus var. **speciosus** Hall. See **Clastoptera lineatocollis** Stal.

Chrysothamnus viscidiflorus var. **puberulus** Jepson. See **Philaronia abjecta** Uhl.

Chrysopis villosa (Pursh.) Nutt. See **Aphrophora permutata** Uhl.

Clover (Sweet White). See **Melilotus alba** Desv.

Cicely (Wooly Sweet). See **Washingtonia claytoni** (Michx.) Britton.

Cichoriaceae. See

Lactuca canadensis L.

Lactuca irrosa L.

Lactuca pulchella (Purch.) DC.

Lactuca spicata (Lam.) Hitchc.

Cirsium altissimum (L) Spreng. Tall or Roadside Thistle. See **Lepyronia quadrangularis** (Say).

*__Clastoptera achatina__ Germ. **Acer** sp. maple (adults, Wirtner); **Carya alba** Britton, White Heart Hickory (adults, Beamer); **Carya** sp. (adults, Wirtner); ***Carya** sp. (nymphs, Garman); ***Carya pecan** Engl. and Graebn., Pecan (National Museum Record); **Corylus** sp. Hazel's (adults, Wirtner); **Tilia** sp. Linden (adults in Arnold Arboretum, Morrison).

Clastoptera arborina Ball. **Thuja occidentalis** L., White Cedar or Arbor Vitae (adults, Ball); **Juniperus virginiana** L. Red Cedar (Nat. Mus. record).

Clastoptera arizonana Doer.

*__Clastoptera binotata__ Ball. **Artemisia tridentata** Nutt, sagebrush (adults, Ball, Gill. and Bak.), *Mentha sp., mint (one nymph and numerous adults, Ball).

Clastoptera brunnea Ball. **Artemisia tridentata** Nutt, Sagebrush (adults, Ball; McDunnough); **Chrysothamnus graveolens** Greene, Rabbit Brush (adults, Ball); **Hymenoclea salsola** T. & G. (Davis).

Clastoptera canyonensia Doer.

Clastoptera delicata Uhl. **Artemisia tridentata** Nutt, sagebrush (Ball, Beamer); **Chrysothamnus graveolens** Greene, Rabbit Brush (Ball, Beamer); **Salsola pestifer** A. Nels. Russian Thistle or cactus (Fox); rank growth of plants in damp grounds (Uhler).

Clastoptera distincta Doer.

Clastoptera elongata Doer. **Betula** sp. birch (adults, Beamer); **Juniperus**, cedar (adults, Beamer); **Populus angustifolia** James. Narrow-leaved Cottonwood (adults, Heinrich).

(To be concluded in the July issue)

REPRINT PRICES

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

Pages	1-2	3-4	5-8	9-12	13-16	17-20	21-24	25-28
50 copies	$1.10	$1.40	$3.85	$5.25	$7.45	$ 9.65	$11.85	$14.05
100 copies	1.40	1.65	4.15	5.80	8.00	10.20	12.40	14.60
200 copies	1.65	2.20	4.95	7.15	9.35	11.55	13.75	15.95
100 Add'n'l	0.55	1.10	2.20	3.30	4.40	5.50	6.60	7.70

Tables—for setting up—$1.25 per page extra.

Covers, per 100—$2.50

Fifty copies of reprints are free to the authors provided at least 50 copies are purchased. Reprints should be ordered in lots of 50 or multiples thereof.

Postage or express charges on carriage of reprints are extra

PRICE OF BACK VOLUMES

Volume 1 ---------------------------$2.00

Volumes 2 to 7 inclusive ------------ 1.00

Volumes 8 to date ----------------- 1.50

Subscriptions for back volumes or numbers should be sent to Donald A. Wilbur, Entomology Department, Kansas State College, Manhattan, Kansas.

CONTENTS OF THIS NUMBER

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

A quarterly journal published in January. April, July and October devoted to Entomology in the Western Mississippi Basin and the proceedings of the Kansas Entomological Society.

Manuscripts for publication may be sent to any of the publication committee.

The Kansas Entomological Society does not make exchanges since the Society does not maintain a library.

Subscription to the Journal must be paid in advance. The subscription rate is so low that second notices are not ordinarily sent out.

Payment of Canadian or other foreign subscriptions and bills must be made by international Postal Money Order or by a draft on a New York bank and payable in U. S. A. dollars.

Subscribers are urged to give us their full cooperation in these matters.

Subscriptions should be sent to Donald A. Wilbur, Entomology Department, Kansas State College. Manhattan, Kansas.

Subscriptions in the U. S. A.,	**$1.50 per year**	**Single Copy**
Canadian or foreign subscriptions,	**1.75 per year**	**60 cents**

KANSAS ENTOMOLOGICAL SOCIETY

Vol. 15, No. 2, A

VOL. 15 JULY, 1942 NO. 3

Journal

OF THE

Kansas Entomological Society

PUBLICATION COMMITTEE
PAUL B. LAWSON, Editor, Lawrence
R. H. BEAMER, Lawrence R. H. PAINTER, Manhattan
DWIGHT ISELY, Fayetteville, Ark.

JAMES WALKER McCOLLOCH
1889-1929

Entered as second-class matter June 7, 1939 at the Post Office at Manhattan, Kansas, under the Act of August 24, 1912

Kansas Entomological Society

Volume 15 July, 1942 Number 3

HOST PLANT RECORDS OF CERCOPIDAE IN NORTH AMERICA, NORTH OF MEXICO (HOMOPTERA)

KATHLEEN C. DOERING, Lawrence, Kansas

(Continued from the April issue)

***Clastoptera funesta** Stal. ***Gardenia** Ellis (nymphs and adults, National Museum record).

Clastoptera globosa Fowl.

Clastoptera hyperici Gib. **Hypericum prolificum** L., Shrubby St. John's Wort (adults, McAtee).

Clastoptera juniperina Ball. **Juniperus virginiana** L., Red Cedar (adults, Ball); **Solanum tuberosum** L. (potatoes in Oregon).

Clastoptera laenata Fowl.

Clastoptera lawsoni Doer. **Vitis** sp., grapes (adults, Hubbard and Pierce).

Clastoptera lineatocollis Stal. **Aplopappus acradensius** (Fox); **Artemisia dracunculoides** Pursh., Linear-leaved Wormwood (Davis); **Artemisia tridentata** Nutt, Sagebrush (adults, Ball, Sweet); **Chrysothamnus nauseosus** var. **speciosus** Hall (Fox); **Croton longipes** Jones (Davis, Fox); **Franseria dumosa** Gray, Burro-Wood (Fox); **Gutierrezia lucida** Greene (Fox); **Mentha** sp. mint (adults, Ball); **Senecio californicus** DC (Sweet).

Clastoptera media Doer.

Clastoptera newporta Doer.

***Clastoptera obtusa** var. **borealis** Ball.

Alnus sp. **alder** (Ball); **Asimina triloba** (L) Dunal, North American Papaw (Doer.); ***Corylus rostrata** Ait., Beaked Hazel-nut (nymphs, Ball); **Juglans** sp. **Walnut** (Doer); **Quercus** sp. oak (Doer.); **Tilia americana** L., Basswood, American Linden or White Wood (Ball); **Vitis** sp. (Ball).

***Clastoptera obtusa** var. **obtusa** (Say). The Alder Spittle Bug. **Aesculus** L. Horse Chestnut (National Museum record); ***Alnus rugosa** Spreng., Smooth Alder; ***Alnus serrulata**=**Alnus rugosa** (Ball, Garman, Lintner, Osborn); **Asimina triloba** (L) Dunal, North American Papaw (Doer); **Azalea nudiflora** L., Honeysuckle (Lintner); ***Betula populifolia** Ait. American White Birch (nymphs, Garman); ***Betula lutea** Michx., Yellow or Grey Birch (nymphs, Garman); ***Carya** (Hicoria), Hickory (nymphs, Garman); ***Hamamelis virginiana** L. Witch Hazel (nymphs, Garman); **Juglans** sp., walnut (Doer.); **Juglans cinerea** L., Butternut (Lintner); ***Ostrya virginiana** (Mill.) Wild. Hop hornbeam or Ironwood (nymphs reared, Readio); **Pinus** sp. Pine (adults in mountains of Colorado, Van Duzee); **Quercus**, Oak (Doer.); **Salix** sp.

Willow (Ball, Van Duzee); **Tilia americana** L., Basswood, American Linden (Ball, Lintner); **Vaccinum** sp. Blueberry (Van Duzee).

Clastoptera obtusa var. **tristis** Van Duz.

Alnus sp (Ball); **Alnus incana** (L) Willd. Speckled or Hoary alder (Brenen); **Tilia** sp., Linden (Arnold Arboretum, Morrison); **Vitis** sp. Grape (Ball).

Clastoptera osborni Gill. and Bak. **Pinus** sp. Pine (adults, Beamer).

Clastoptera ovata Doer.

Clastoptera pallidocephala Doer. **Prunus Persica** Batsch. Peach. (National Museum record).

***Clastoptera proteus** var. **nigricollis** Fitch. The Blueberry Spittle-bug or The Dogwood Spittle-bug. **Cornus alba** L. Dogwood (adults, Arnold Arboretum); **Cornus Amomum** Mill., Silkey Cornel or Kinnikinnik (Arnold Arboretum); **Cornus racemosa** Lam., Dogwood (Arnold Arboretum); **Cornus stolonifera** Michx. Red Osier Dogwood (adults, Van Duzee); ***Vaccinum** sp. Blueberry (eggs, nymphs, Garman, adults, Arnold Arboretum); **Oxycoccus macrocarpus**, Large or American Cranberry (Ait) Pers.

Clastoptera proteus var. **osceola** Ball. **Vaccinum** sp., Blueberry (Arnold Arboretum).

***Clastoptera proteus** var. **proteus** Fitch. ***Cornus** sp., Dogwood (nymphs, Kansas); **Cornus candidissima** Marsh, Panicled Dogwood (adults, Fitch).

Clastoptera saint-cyri var. **anceps** McAtee. Low vegetation in Michigan (Hungerford); **Vaccinum** sp., Blueberry (Arnold Arboretum); **Arctostaphylos uva-ursi** Spreng., Bearberry (adults, Beamer).

***Clastoptera saint-cyri** var. **saint-cyri** Provancher. Low vegetation in Michigan (Hungerford); **Gaylussacia** H.B.K. (National Museum record); **Leucothoe** sp. Evergreen Shrub (Arnold Arboretum); ***Oxycoccus macrocarpus** (Ait.) Pers. Large or American cranberry (nymphs, reared, National Museum); **Vaccinum** sp., Blueberry (Arnold Arboretum, Beamer); **Vaccinum pennsylvanicum** Lam., Dwarf, Lowbush or Sugar Blueberry (Brenen).

Clastoptera salicis Doer. **Salix amygdaloides** Anders. Peach-leaved Willow (Snow Entomological collection); **Salix longifolia** Muhl., Sandbar Willow, River Bank Willow (same collection).

Clastoptera sierra Doer.

Clastoptera siskiyou Doer. Low bush in Arizona (Beamer).

***Clastoptera testacea** Fitch. **Pinus**, pine (nymphs, Lintner). **Pinus strobus** L. white pine (National Museum record); **Quercus** L. Oak (Natonal Museum record).

Clastoptera texana Doer. **Carya pecan** Engl and Graebn. Pecan (Nat. Mus. record).

Clastoptera tricincta Doer.

***Clastoptera xanthocephala** var. **unicolor** Fowl.

*__Ambrosia elatior__ L. Hogwood, Ragweed, Roman Wormwood, Wild Tansy (nymphs, Heidemann); **Pinus virginiana** Mill., Scrub Pine (winters among foliage, McAtee).

***Clastoptera xanthocephala** var. **xanthocephala** Germ. ***Ambrosia** sp. (nymphs, a favorite plant, Ball); **Ambrosia trifida** L. Horseweed (National Museum record); **Anthemis arvensis** L. Corn or Field Camomile (National Museum record); ***Helianthus** sp. Sunflower (nymphs another favorite plant, Ball); **Helenium tenuifolium** Nutt. Fine-leaved Sneeze weed (National Museum record); *Grass (nymphs, Ball); *Many shrubs (nymphs, Ball); *many trees (nymphs, Ball).

Clastoptera uniformia Doer. **Juglans nigra** L. Black Walnut (adults swept, Beamer).

Cleavers. See **Galium aparine** var. **vaillantii** L.

Clematis ligusticifolia Nutt. Western Virgin's Bower. See **Lepyronia quadrangularis** (Say).

Colutea L. Bladder-Senna. See **Philaenus leucophthalmus** L.

Compositae. See

Ambrosia sp.
Ambrosia elatior L.
Ambrosia trifida L.
Aplopappus acradensius
Artemisia dracunculoides Pursh.
Artemisia ludoviciana Nutt.
Artemisia tridentata Nutt.
Aster paniculatus Lam.
Aster salicifolius Lam.
Chrysanthemum sp.
Chrysopsis villosa (Pursh.) Nutt.
Chrysothamnus graveolans Greene.
Chrysothamnus nauseosus var. **speciosus** Hall.
Chrysothamnus viscidiflorus var. **puberulus** Jepon.
Cirsium altissimum (L) Spreng.
Erigeron ramosus (Walt.) B.S.P.
Eupatorium altissimum L.
Franseria dumosa Gray.
Gutierrezia lucida Greene.
Helianthus sp.
Helianthus grosse-serratus Martens.
Helianthus petiolaris Nutt.
Heliopsis scabra Dunal.

Cotton. See Gossypium.

Cottonwood (Narrow-leaved). See **Populus angustifolia** James.

Cow-Parsnip. See **Heracleum lanatum** Michx.

Cranberry. See **Oxycoccus macrocarpus** (Ait.) Pers.

Croton longipes Jones. See **Clastoptera lineatocollis** Stal.

Currant (Indian). See **Symphoricarpos orbiculatus** Moench.

Cyperaceae. See **Carex** sp.

Cytisus (Tourn.) L. Broom.

Dactylis glomerata L. Orchard Grass. See **Philaenus lineatus** (Linn.).

Dandelion. See **Leontodon taraxacum** L.

Dewberry. See **Rubus canadensis** L.

Diervilla Adans. See **Philaenus leucophthalmus** L.

Dirca palustris L. Leatherwood. See **Philaenus leucophthalmus** L.

Dogbane. See **Apocynum cannabinum** L.

Dog-bane (Velvet). See **Apocynum pubescens** R. Br.

Dogwood. See

- **Cornus** sp.
- **Cornus alba** L.
- **Cornus baileyi** Coult. and Evans.
- **Cornus racemosus** Lam.

Dogwood (Panicled). See **Cornus candidissima** March

Dogwood (Red Osier). See **Cornus stolonifera** Michx.

Dogwood Spittle-bug. See **Clastoptera proteus** var. **nigricollis** Fitch

Dragon-head. See **Prunella vulgaris** L.

Elder. See **Sambucus callicarpus** Greene.

Enkianthus Lour. sp. See **Philaenus leucophthalmus** L.

Elm (Moose). See **Ulmus fulva** Michx.

Elm (Red). See **Ulmus fulva** Michx.

Elm (Slippery). See **Ulmus fulva** Michx.

Ericaceae. See

- **Arctostaphylos uva-ursi** Spreng.
- **Azalea nudiflora** L.

Erigeron ramosus (Walt.) B.S.P. Daisy Fleabane. See
Clastoptera quadrangularis (Say).

Euonymus L. Burning Bush. See **Philaenus leucophthalmus** L.

Eupatorium altissimum L. Tall Thoroughwort. See
Lepyronia quadrangularis (Say).

Euphorbiaceae. See **Croton longipes** Jones.

Fagaceae. See **Quercus** sp.

Fern. See **Aphrophora saratogensis** (Fitch).

Fleabane (Canada). See **Leptilon canadense** (L) Britton.

Fleabane (Daisy). See **Erigeron ramosus** (Walt.) B.S.P.

Fontonea sp. See **Philaenus leucophthalmus** L.

Fragaria sp. Strawberry. See **Philaenus leucophthalmus** and varie-

ties (Federal Bureau of Entomology Records).

Franseria dumosa Gray. Burro-weed. See **Clastoptera lineatocollis** Stal.

Gardenia Ellis. See **Clastoptera funesta** Stal.

Galium aparine var. **vaillantii** L. Cleavers, Goose-grass. See **Lepyronia quadrangularis** (Say).

Gaylussacia H.B.K. Huckleberry. See **Clastoptera saint-cyri** Prov.

Genista L. See **Philaenus leucophthalmus** L.

Geraniaceae. See **Geranium** sp.

Geranium sp. See **Philaronia abjecta** (Uhl.).

Geum canadensis Jacq. White Avens. See **Lepyronia quadrangularis** (Say).

Geum strictum Ait. Yellow Avens. See **Lepyronia quadrangularis** (Say).

Giant Umbellifera. See **Heracleum lanatum** Michx.

Golden-rod sp. See **Solidago** sp.

Golden-rod (Double). See **Solidago altissima** L.

Golden-rod (Stiff-Leaved). See **Solidago rigida** L.

Golden-rod (Tall). See **Solidago altissima** L.

Goosefoot (White). See **Chenopodium album** L.

Gossypium L. See **Lepyronia angulifera** Uhl.

Gramineae. See
- **Andropogan furcatus** Muhl.
- **Bromus secalinus** L.
- **Dactylis glomerata** L.
- **Panicum virgatum** L.
- **Panicum wilcoxianum** Vasey.
- **Phleum pratense** L.
- **Poa pratensis** L.
- **Setaria lutescens** (Weigel) F. T. Hubb.
- **Triodia flava** (L) Smyth
- **Triticum aestivum** L.
- **Zea Mays** L.

Grape. See **Vitis** sp.

Grass. See:
- **Aphrophora quadrinotata** Say.
- **Clastoptera xanthocephala** var. **xanthocephala** Germ.

Grass (Blue-joint). See **Andropogan furcatus** Muhl.

Grass (Forked Beard). See **Andropogan furcatus** Muhl.

Grass (Goose). See **Galium aparine** var. **vaillantii** L.

Grass (Herd's). See **Phleum pratense** L.

Grass (June). See **Poa pratensis** L.

Grass (Kentucky Bluegrass). See **Poa pratensis** L.

Hypericum sp.
Hypericum prolificum L.
Triadenum virginicum (L) Ref.

Hypericum L. sp. See **Philaenus leucophthalmus** L.

Hypericum prolificum L. Shrubby St. John's Wort. See
Clastoptera hyperici Gib.

Hymenoclea salsola T. and G. See **Clastoptera brunnea** Ball.

Iberis L. See **Philaenus Leucophthalmus** L.

Ilex opaca Ait. See **Tomaspis bicincta** (Say).

Ironweed (Baldwin's). See **Vernonia baldwinii** Torr.

Ironweed (Yellow). See **Ridan alternifolius** (L) Britton.

Ironweed. See **Ostrya virginiana** (Mill.) Willd.

Juglandaceae See
Carya (Hicoria).
Carya alba Britton.
Juglans.
Juglans cinerea L.
Juglans nigra L.

Juglans. Walnut. See
Clastoptera obtusa var. **obtusa** (Say).
Clastoptera obtusa var. **borealis** Ball.

Juglans cinerea L. **Butternut.** See:
Clastoptera obtusa var. **obtusa** (Say).

Juglans nigra L. Black walnut. See
Clastoptera uniformia Doer.
Lepyronia quadrangularis (Say).

Juniper. California. See **Juniperus californica** Carr.

Juniperus sp. Cedar. See **Clastoptera elongata** Doer.

Juniperus californica Carr. (J. utahensis Lem). California Juniper.
See **Philaronia abjecta** Uhl.

Juniperus virginiana L. Red cedar. See
Clastoptera juniperina Ball.
Clastoptera arborina Ball.

Kerria DC . See **Philaenus leucophthalmus** L.

Kinnikinnik. See **Cornus Amomum** Mill.

Labiatae. See
Mentha sp. Mint.
Lycopus americanus Muhl.
Prunella vulgaris L.
Stachys palustris L.

Lactuca canadensis L. (Wild or Tall Lettuce). See
Lepyronia quadrangularis (Say).

Lactuca irrosa L. (Prickly or Wild Lettuce). See

Lepyronia quadrangularis (Say).

Lactuca pulchella (Pursh). DC. (Large Flowered Blue Lettuce). See **Lepyronia quadrangularis** (Say).

Lactuca spicata (Lam.) Hitchc. (Tall Blue Lettuce). See **Lepyronia quadrangularis** (Say).

Leatherwood. See **Dirca palustris** L.

Larch, American. See **Larix laricina** (DuRoi) Koch.

Larix laricina (Du Roi) Koch. American Larch, Tamarack. See **Aphrophora saratogensis** (Fitch).

Leguminosae. See
- **Lupinus** sp.
- **Melilotus alba** Desv.
- **Robinia pseudoacacia** L.

Leontodon taraxacum L. Dandelion, Blowball. See **Lepyronia quadrangularis** (Say).

Leptilon canadense (L) Britton. Canada Fleabane, Horseweed. See **Lepyronia quadrangularis** (Say).

Lepyronia angulifera Uhl. Gossypium, cotton. (National Museum data).

Lepyronia angulifera var. **minuenda** Ball.

Lepyronia gibbosa Uhl. Prairie Grass (adults, Beamer); collected only in sandy areas (Ball).

***Lepyronia quadrangularis** (Say). *Nymphs found feeding on all of the following plants by Doering. Additional author references are given in parentheses.
- **Acer** sp. Maples (Wirtner).
- **Agrimonia gyrposepala** Wallr. Agrimony
- **Ambrosia artemisifolia.** See **Ambrosia elatior** L.
- **Ambrosia trifida** L. Horseweed, Horse-cane, Bitterweed, Great Ragweed.
- **Ambrosia elatior** L. Hogwood, Roman Wormwood, Wild Tansy.
- **Andropogan furcatus** Muhl. Forked Beardgrass, Blue-joint, Turkey foot.
- **Apocynum cannabinum** L. Amy-root, Dogbane, Indian Hemp.
- **Apocynum pubescens** R. Br. Velvet Dogbane.
- **Asclepias syriaca** L. Common Milkweed.
- **Asclepias tuberosa** L. Butterfly-weed or Pleurisy Root.
- **Asclepias verticillata** L. Whorled Milkweed.
- **Aster paniculatus** Lam. Tall white or Panicled Aster.
- **Aster salicifolius** Lam. Willow Aster.
- **Bromus secalinus** L. Chess or Cheat.
- **Carex** sp. Sedge (Gill. and Bak.).
- **Chenopodium album** L. Lam's Quarter, White Goosefoot, Pigweed.
- **Cirsium altissimum** (L) Spreng. Tall or Roadside Thistle.

Clematis ligusticifolia Nutt. Western Virgin's Bower (also adults, Gill. and Bak.).

Cornus baileyi Coult. and Evans. Dogwood.

Corylus sp. Hazels (also Wirtner).

Leptilon canadense (L) Britton. Horse-weed, Canada Fleabane.

Erigeron ramosus (Walt.) B.S.P. Daisy Fleabane.

Eupatorium altissimum L. Tall Thoroughwort.

Galium aparine var. **vaillantii** L. Cleavers, Goose-Grass.

Geum canadense Jacq. White Avens.

Geum strictum Ait. Yellow Avens.

Helianthus grosse-serratus Martens. Saw-tooth Sunflower

Helianthus petiolaris Nutt. Prairie Sunflower.

Heliopsis scabra Dunal. Rough Ox-eye.

Juglans nigra L. Black Walnut.

Lactuca canadensis L. Wild or Tall Lettuce.

Lactuca pulchella (Pursh) DC. Large Flowered Blue Lettuce.

Lactuca irrosa L. Prickly or Wild Lettuce.

Lactuca spicata (Lam.) Hitchc. Tall Blue Lettuce.

Lycopus americanus Muhl. Cut-leaved Water Hoarhound.

Melilotus alba Desv. White Melilot. Sweet White Clover.

Morus rubra L. Red Mulberry.

Washingtonia Claytoni (Michx.) Britton. Wooly Sweet Cicely.

Panicum virgatum L. Tall Smooth Panicum.

Panicum Wilcoxianum Vasey.

Phleum pratense L. Timothy or Herd's Grass.

Plantago Rugelii Done. Rugel's or Pale Plantain.

Prunella vulgaris L. Self-heal. Heal-all. Dragon-head.

Quercus virginiana Mill. Live Oak (National Museum data).

Rhus glabra L. Smooth Upland or Scarlet Sumac.

Ridan alternifolius (L) Britton. Wing stem or Yellow Ironweed.

Robinia pseudoacacia L. Locust-tree, False or Bastard Acacia, Silver-chain or Black Locust.

Rosa setigera Michx. Prairie Rose, Climbing Rose.

Rubus sp. Blackberry.

Rubus canadensis L. Low Running Blackberry, Dewberry.

Rubus occidentalis L. Black raspberry.

Rudbeckia fulgida Ait. Orange or Brilliant Coneflower.

Ruellia ciliosa Pursh. Hairy or Long-tube Ruellia.

Ruellia parviflora (Nees) Britton. Slender Hairy Ruellia.

Sambucus. Elder.

Sanicula canadensis L. Short-styled Snakeroot.

Sanicula marylandica L. Black Snakeroot.

Solidago altissima L. Tall, high or Double Golden-rod.

Milkweed (Common). See **Asclepias syriaca L.**

Milkweed (Whorled). See **Asclepias verticillata L.**

Mint. See **Mentha** sp.

Moraceae. See **Morus rubra** L.

Morus rubra L. Red Mulberry. See **Lepyronia quadrangularis** (Say).

Mugwort, Dark-Leaved. See **Artemisia ludoviciana** Nutt.

Mulberry (Red). See **Morus rubra** L.

Nettle (Slender). See **Urtica gracilis** Ait.

Oak. See **Quercus** sp.

Oak, Live. See **Quercus virginiana** Mill.

Ostrya Virginiana (Mill.) Willd. Hop Hornbeam or Iron-wood. See **Clastoptera obtusa** var. **obtusa** (Say).

Ox-eye (Rough). See **Heliopsis scabra** Dunal.

Oxycoccus macrocarpus (Ait) Pers. Large or American Cranberry. See **Clastoptera proteus** var. **nigricollis** Fitch.

Panicum (Tall Smooth). See **Panicum virgatum** L.

Panicum virgatum L. Tall Smooth Panicum. See **Lepyronia quadrangularis** (Say).

Panicum wilcoxianum Vasey. See **Lepyronia quadrangularis** (Say).

Papaw. See Asimina **triloba** (L) Dunal.

Peach. **Prunus persica** Batsch. See **Clastoptera pallidocephala** Doer.

Pecan. See **Carya pecan** Engl. and Graebn.

Phellodendron Rupr. See **Philaenus leucophthalmus** L.

Philaenus canadensis Walley.=**Philaronia abjecta** var. **provana** Ball.

Philaenus leucophthalmus L. (The following records are taken from National Museum records and include the color varieties):

- **Acer** L .sp. Maple.
- **Aesculus parviflora** Walt. Horse Chestnut, Buckeye.
- **Alyssum** L.
- **Aronia** Pero. Chokeberry.
- **Berberis** L. Barberry.
- **Callicarpa** L.
- **Colutea** L. Bladder-Senna.
- **Cotoneaster** Med.
- **Cornus alba** L. Dogwood.
- **Cytisus** (Tourn.) L. Broom.
- **Diervilla** Adans. sp.
- **Dirca palustris** L. Leatherwood.
- **Enkianthus** Lour. sp.
- **Euonymus** L. Burning Bush.
- **Fontonea** sp.
- **Genista** L.
- **Helianthemum** Adans. Sun-Rose.
- **Hypericum** L. sp. St. John's wort.

Iberis L. sp. Candytuft.
Kerria DC.
Ligustrum L. Privet.
Lonicera L. Honey Suckle.
Phellodendron Rupr.
Pinus L. sp. Pine.
Rosa L. sp. Rose.
Salix alba var. **sericea** Gand. White Willow.
Staphylea L. Bladdernut.
Tilia L. Linden.
Vaccinum L.

Philaenus leucophthalmus var. **fabricii** Van Duz.
Philaenus leucophthalmus var. **fasciatus** (Fabr.).
Philaenus leucophthalmus var. **lateralis** (Linn.).

Philaenus leucophthalmus var **leucocephalus** (Linn.).
The Meadow Froghopper. The Strawberry Spittle-bug. Strawberries (Federal Bureau of Entomology records).

***Philaenus leucophthalmus** var. **marginellus** (Fabr.).
***Rosa polyantha** Hort. Baby Rambler Rose in greenhouse (nymphs, Breakey).

***Philaenus leucophthalmus** var. **pallidus** (Zett.). ***Rosa polyantha** Hort. Baby Rambler Rose in greenhouse (nymphs, Breakey).

***Philaenus leucophthalmus** var. **spumarius** (Fall.).
***Rosa polyantha** Hort. Baby Rambler in greenhouses (nymphs, Breakey). **Setaria lutescens** (Weigel) F. T. Hubb. Yellow Bristle Grass, Yellow Foxtail or Pigeon-grass (eggs laid in captivity, Barber and Ellis).

***Philaenus lineatus** (Linn.).
Acer L. sp. Maple (National Museum record).
Dactylis glomerata L. Orchard grass (nymphs, Garman).
Grasses near extensive salt marshes (Barber and Ellis).
Phleum pratense L. Timothy, Herd's Grass (nymphs, Garman).
Poa pratensis L. Kentucky Blue-grass. June-grass.
Setaria lutescens (Weigel) F. T. Hubb. Yellow Bristle grass or Yellow Fox-tail, Pigeon-grass (eggs laid in captivity, Barber an Ellis).
Tilia L. Linden. (National Museum record).
Triodia flava (L) Smyth. Purple-top or Red-top (nymphs, Garman).
Common on all kinds of herbage (Edwards).

Philaenus parallelus Stearns. **Carex** sp. Sedge between clumps of cranberries (adults, Ball, Stearns).

***Philaronia abjecta** (Uhl.).
Chrysothamnus viscidoflorus var. **puberulus** Jepson (adults, Dorst).

*__Geranium__ sp. (nymphs on roots, Ball).
Helianthus grosse-serratus Martens. Saw-tooth Sunflower.
Juniperus utahensis Lem.=**Juniperus californica** Carr. California Juniper (National Museum record).
*__Lupinus__ sp. Lupine (nymphs on roots, Ball).
Solidago sp. Goldenrod (adults, Brennen, Walley).
Salsola pestifer A. Nelson. Russian Thistle or cactus (National Museum record).

Philaronia abjecta var. **provana** Ball. **Helianthus grosse-serratus** Martens. Saw-tooth Sunflower (adults, Ball).

*__Philaronia bilineata__ var. **bilineata** (Say). **Setaria lutescens** (Weigel) F. T. Hubb, Yellow Bristle Grass, Yellow Foxtail or Pigeon-grass (eggs laid in captivity, Barber and Ellis); **Medicago sativa** L. alfalfa (Wyo., Fox).

Philaronia bilineata var. **nigricans** Ball.

Philaronia bilineata var. **orbiculata** Ball.

Philaronia bilineata var. **reticula** Ball.

Phleum pratense L. See
Lepyronia quadrangularis (Say).
Philaenus lineatus (Linn).

Pigweed. See **Chenopodium album** L.

Pinaceae. See
Juniperus sp.
Juniperus virginiana L.
Larix laricina (Du Roi) Koch.
Pinus sp.
Pinus banksiana Lamb. Jack or Grey Northern Pine.
Pinus rigida Mill. Pitch Pine.
Pinus sabiniana Dougl. Digger Pine.
Pinus strobus L. White Pine or Weymouth Pine.
Pinus sylvestris L. Scots or Scotch Pine.
Pinus virginiana Mill.
Thuja occidentalis L.
Tsuga canadensis Carr.

Pine sp. See **Pinus.**
Pine (Digger). See **Pinus sabiniana** Dougl.
Pine (Grey or Northern Pine). See **Pinus banksiana** Lamb.
Pine (Jack). See **Pinus banksiana** Lamb.
Pine (Pitch). See **Pinus rigida** Mill.
Pine (Scrub). See **Pinus virginiana** Mill.
Pine (Scots or Scotch). See **Pinus sylvestris** L.
Pine (Weymouth). See **Pinus strobus** L.
Pine (White). See **Pinus strobus** L.
Pine Spittle Bug. See **Aphrophora parallela** (Say).

Quercus virginiana Mill. Live Oak. See
Lepyronia quadrangularis (Say).

Rabbit-brush. See **Chrysothamnus graveolans** Greene.

Ragweed. See **Ambrosia elatior** L.

Ranunculaceae. **Clematis ligusticifolia** Nutt.

Raspberry (Black). See **Rubus occidentalis** L.

Rhus glabra L. Smooth Upland or Scarlet Sumac. See
Lepyronia quadrangularis (Say).

Ridan alternifolius (L) Britton. Wing Stem, Yellow Ironweed. See
Lepyronia quadrangularis (Say).

Robinia pseudoacacia L. Black Locust, Chain Locust, False Acacia, Locust-tree, Silver Locust. See **Lepyronia quadrangularis** (Say).

Rosaceae. See
Agrimonia gyrposepala Walbr.
Geum canadensis Jacq.
Geum strictum Ait.
Rosa L. sp.
Rosa polyantha Hort.
Rubus sp.
Rubus canadensis L.
Rubus occidentalis L.

Rose (Baby Rambler). See **Rosa polyantha** Hort.

Rosa L. sp. See **Philaenus leucophthalmus** L.

Rosa polyantha Hort. Baby Rambler Rose. See
Philaenus leucophthalmus var. **marginellus** (Fabr.).
Philaenus leucophthalmus var. **pallidus** (Zett.).
Philaenus leucophthalmus var. **spumarius** (Fall.).

Rubiaceae. See **Galium aparine** var. **vaillantii** L.

Rubus sp. Blackberry. See **Lepyronia quadrangularis** (Say).

Rubus canadensis L. Running Blackberry. Dewberry. See
Lepyronia quadrangularis (Say).

Rubus occidentalis L. Black Raspberry. See
Lepyronia quadrangularis (Say).

Rudbeckia fulgida Ait. Orange or Brilliant Cone-flower. See
Lepyronia quadrangularis (Say).

Ruellia (Hairy). See **Ruellia ciliosa** Pursh.

Ruellia (Long-tube). See **Ruellia ciliosa** Pursh.

Ruellia (Slender Hairy). See **Ruellia parviflora** (Nees) Britton.

Ruellia ciliosa Pursh. Hairy or Long-tube Ruellia. See
Lepyronia quadrangularis (Say).

Ruellia parviflora (Nees) Britton. Slender Hairy Ruellia See
Lepyronia quadrangularis (Say).

Sage. See **Artemisia ludoviciana** Nutt.

Sagebrush. See **Artemisia tridentata** Nutt.

Lepyronia quadrangularis (Say).

Solidago rigida L. Stiff or Hard-leafed Golden-rod. See
Lepyronia quadrangularis (Say).

St. John's Wort. See **Hypericum** L.

St. John's Wort (Marsh). See **Triadenum virginicum** (L) Ref.

St. John's Wort (Shrubby). See **Hypericum prolificum** L.

Stachys palustris L. Clown's Woundwort, Hedge-Nettle, Marsh.

Staphylea L. **Bladdernut.** See **Philaenus leucophthalmus** L.

Strawberry. See **Fragaria.**

Sumac (Scarlet). See **Rhus glabra** L.

Sumac (Smooth Upland). See **Rhus glabra** L.

Sunflower (Prairie). See **Helianthus petiolaris** Nutt.

Sunflower (Saw-tooth). See **Helianthus grosse-serratus** Martens.

Sun-Rose. See **Helianthemum** Adan.

Symphoricarpos orbiculatus Moench. Coral-berry, Indian Currant. See
Lepyronia quadrangularis (Say).

Tamarack. See **Larix laricina** (Du Roi) Koch.

Tansy (Wild). See **Ambrosia elatior** L.

Thistle (Roadside). See **Cirsium altissimum** (L) Spreng.

Thistle (Tall). See **Cirsium altissimum** (L) Spreng.

Thistle (Russian). See **Salsola pestifer** A. Nelson.

Thoroughwort (Tall). See **Eupatorium altissimum** L.

Thuja occidentalis L. White Cedar or Arbor Vitae. See
Clastoptera arborina Ball.

Tilia L. sp. Linden. See
Clastoptera achatina Germ.
Clastoptera obtusa var. **tristis** Van Duz.
Philaenus leucophthalmus L.
Philaenus lineatus L.

Tilia Americana L. American Linden, Basswood. See
Clastoptera obtusa var. **borealis** Ball.
Clastoptera obtusa var. **obtusa** (Say).

Tiliaceae. See
Tilia sp. Linden.
Tilia Americana L.

Timothy. See **Phleum pratense** L.

***Tomaspis bicincta** (Say).
*Lower stems and roots of grass clumps (nymphs, Ball); *sugar cane; and holly (adults).

Tomaspis bicincta var. **ignipecta** Fitch.

Triadenum virginicum (L) Ref. Marsh St. John's Wort. See
Lepyronia quadrangularis (Say).

Triodia flava (L) Smyth. Purple-top. Tall Red-top. See
Lepyronia quadrangularis (Say).

  Philaenus lineatus (Linn).
Triticum aestivum L. Wheat. See **Lepyronia quadrangularis** (Say).
Tsuga canadensis Carr. See **Aphrophora parallela** (Say).
Ulmaceae. See **Ulmus fulva** Michx.
Ulmus fulva Michx. Slippery Elm, Red Elm, or Moose Elm. See
  Lepyronia quadrangularis (Say).
Umbelliferae. See
  Heracleum lanatum Michx.
  Sanicula canadensis L.
  Sanicula Marylandica L.
  Washingtonia Claytoni (Michx.) Britton.
Urtica gracilis Ait. Slender Nettle. See
  Lepyronia quadrangularis (Say).
Urticaceae. See **Urtica gracilis** Ait.
Vaccinaceae. See
  Oxycoccus macrocarpus (Ait.) Pers.
  Vaccinum sp.
  Vaccinum pennsylvanicum Lam.
Vaccinum L. sp. Blueberry. See
  Clastoptera obtusa var. **obtusa** (Say).
  Clastoptera proteus var. **nigricollis** Fitch.
  Clastoptera proteus var. **osceola** Ball.
  Clastoptera saint-cyri var. **anceps** McAtee.
  Clastoptera saint-cyri var. **saint-cyri** Provancher.
  Philaenus leucophthalmus L.
Vaccinum pennsylvanicum Lam. Dwarf, Sugar or Lowbush Blueberry.
  See **Clastoptera saint-cyri** var. **saint-cyri** Prov.
Verbena urticifolia L. White or Nettle-leaved Vervain. See
  Lepyronia quadrangularis (Say).
Verbenaceae. See **Verbena urticifolia** L.
Vernonia baldwinii Torr. Baldwin's Ironweed. See
  Aphrophora quadrinotata Say.
  Lepyronia quadrangularis (Say).
Vervain (Nettle-leaved). See **Verbena urticifolia** L.
Vervain (White). See **Verbena urticifolia** L.
Virgin's Bower (Western). See **Clematis ligusticifolia** Nutt.
Vitaceae. See **Vitis** sp.
Vitis sp. Grape. See
  Aphrophora signoreti Fitch.
  Aphrophora quadrinotata Say.
  Clastoptera lawsoni Doer.
  Clastoptera obtusa var. **borealis** Ball.
  Clastoptera obtusa var. **tristis** Van Duz.
Walnut. See **Juglans** sp.
Walnut (Black). See **Juglans nigra** L.

THE ALFALFA PLANT BUG (ADELPHOCORIS LINEOLATUS GEOZE) IN NEBRASKA (HEMIPTERA; MIRIDAE)

EDWARD C. KLOSTERMEYER, University of Nebraska

The alfalfa plant bug (**Adelphocoris lineolatus** Geoze), first recorded in the middle west by Knight and since found in other midwestern states, has been present in Nebraska at least since June 10, 1936 when it was collected at lights at Omaha by the writer. Although a light trap project had been in progress at Lincoln from 1933 to 1938 there are no further records of this insect in the state until August 22, 1940 when it was swept from alfalfa in Lincoln by H. D. Tate.

On May 21, 1941 it was collected at lights in Lincoln by the writer and was numerous at lights throughout the summer. During 1941 the bug was found in both the adult and nymphal stages on alfalfa, potatoes, and beans, and two adults were collected on wheat. Except for a single adult taken at Osceola, Nebraska by D. B. Whelan, no other species have been collected in the state. Sweepings of a five acre alfalfa field on the college of agriculture campus were made throughout the summer of 1941 and a gradual build-up in population of the bug was observed until on September 9 a maximum of 37 adults and nymphs were collected in 100 sweeps. On October 4 only one bug could be found in 100 sweeps of the field.

Although this survey was of a limited area, the population that developed indicates that the bug might easily become an important pest of alfalfa in the middle west.

BIOLOGY OF THE SQUASH BLISTER BEETLE[1,2]

WILLIAM R. HORSFALL, University of Arkansas

The squash blister beetle was a pest of importance in gardens in northwestern Arkansas in the summer of 1939 and to a limited extent in 1940. Gardens surrounded by or bordering in meadow land or adjacent to open woods were more often injured than others in in 1939 outbreak. Most serious injury was observed in gardens adjacent to favored oviposition sites of the differential[3] and two-striped[4] grasshoppers.

The squash blister beetle is so named because it is the common blister beetle that attacks squash. Its range of hosts is wide and includes both wild as well as cultivated plants. Primarily the adult beetles are flower feeders and are attracted to several species of cucurbits, alfalfa, and a wild composite known as the western daisy.[5] All parts of flowers are destroyed, but the pollen is especially sought after. As accessory foods, fruits of squash and tomatoes may be chosen, and in 1939 considerable damage to these crops resulted. In one garden, late blossoms of squash and young fruits were completely destroyed, and older fruits were scarified on the surface disfiguring them and lowering their market value. On one occasion, several beetles were collected while they were feeding on the gills and lower sides of mushroom sporophores.

Range. This species may be found in the region east of the Rocky Mountains eastward to the Mississippi River from South Dakota southward to the Gulf of Mexico. In Arkansas, it is most common in the Ozark region in the northwestern part of the state. It has been found in the delta region of east central Arkansas where its hosts, both larval and adult, have been abundant for several years.

Description. This species may be readily recognized in the field as plump, dull black beetles with elytra reduced enough to expose two yellow subdorsal spots on the abdomen. These beetles are incapable of flight, but they may often go several hundred yards on foot at times. While these beetles vary greatly in size, they are larger than most local species as an average.

---

1 **Henous confertus** Say. (Meloidae, Coleoptera)

2 Research Paper No 728, Journal Series, University of Arkansas. Approved for publication by the Director of the Arkansas Agricultural Experiment Station.

3 **Melanoplus differentialis** (Thos.)

4 **M. bivittatus** Say.

5 **Bellis integrifolia** Michx. Determined by D. M. Moore, Department of Botany, University of Arkansas.

The following is the original description by Say (3). "Body black, opaque, punctured; punctures crowded, concave, equally distributed, confluent, furnishing short black hairs; head with separated punctures on the anterior part of the front, distant ones on the clypeus, and remote ones on the labium: antennae regular: thorax as wide as the head, emarginate at base; sides very slightly arquated, hardly narrower at base; a longitudinal, dorsal, acute, impressed line: elytra scabrous, with minute elevated points, and numerous short black hairs. Length of male half, female four-fifths of an inch."

METHODS

Observations on which this paper is based were made during the interval between 1939 and 1941 at the Arkansas Agricultural Experiment Station, Fayetteville, Arkansas.

Rearing work was carried out in an incubator and in field cages which were designed to simulate natural conditions. Larvae were reared through their feeding period in individual glass tubes such as were used in rearing the back blister beetle (2). At the end of the feeding period, larvae were transferred to four-dram vials half filled with packed, moist soil.

Outdoor rearing chambers made of large glazed earthenware jars gave results comparable to natural conditions. Two cylindrical crocks, an outer one of a three-gallon size and an inner one of a two-gallon size provided the best combination. The inside one was suspended from the rim of the outer one by means of its shoulders. Vials and tubes containing larvae were placed on the bottom of the inner crock. These were covered by a circle of cellotex fitted snugly inside the inner crock as a preventive against sudden or great changes in temperature. A second check against outside air fluctuations was provided by a larger circle of cellotex fitted over the top of the crocks. The whole was made water tight by an over all covering of an inverted pot saucer of the twelve-inch size. A record of the temperature was kept by daily reading of a maximum-minimum thermometer inside the crock. Temperatures in such chambers were very similar most of the year to those recorded by a soil thermograph whose element was placed in the soil at a three-inch level.

LIFE HISTORY

Oviposition Habits. This species, like other common ones (1), lays its eggs at the bottom of narrow, tubular cavities. Firm soil preferably near some raised surface feature such as a clod, stick, stone, or bunch of grass is most often sought as an oviposition site.

The tube varies in diameter as the diameter of the individual beetle constructing it varies, and when complete, the walls may touch but not press against the beetle. Usually the bottom of the cavity is only an inch or less below the surface. The eggs are placed in a compact mass of more or less horizontal rows in the bottom of the cavity. Finally the cavity is plugged and sealed with soil as in the case of the black blister beetle(2).

The number of eggs in a mass m..y vary from 35 to 224 depending on the diet of the beetles. Those fed on a diet of leaves and fruit deposited masses having a mean 113 ± 3 eggs each, while those fed on a diet rich in pollen deposited masses having a mean of 164 ± 6 eggs each.

Egg Stage. An egg of this species is clearly different in size and general appearance from that of any species of Epicauta or Macrobasis that were observed. It is large by comparison, varying in length from 1.750 to 2.435 mm. with a mean length of 2.044 ± 0.010 mm. An individual egg is orange-yellow and is covered with a kind of reddish watery liquid which tends to collect in droplets. This liquid is sufficiently sticky to cause the eggs to remain in masses even when removed from the egg cavities. The combined color of the eggs and the liquid gives to a mass of eggs a reddish-orange cast.

The rate of egg development is directly influenced by temperature. Within normal range of conditions, eggs hatch in an interval of 16 to 26 days. In the laboratory, where the temperature was kept fairly constant about a mean of 80° F., 626 eggs required a mean of 16.8 ± 0.1 days for development. Under field conditions, where temperature fluctuations were greater and averaged six or eight degrees lower, 665 eggs required a mean of 24.1 ± 0.1 days for development. About 90 percent of the eggs under both sets of conditions hatched indicating that the range was within normal bounds.

LARVAL STAGE. The larvae are predacious on eggs of common species of grasshoppers especially those of the differential and two-striped grasshoppers. This fact is illustrated by field records of a high percentage of predatism on eggs of these two grasshoppers. At two different places in northwestern Arkansas in 1940 and 1941, as high as 23 per cent of the egg masses were wholly or almost wholly destroyed. The oviposition habits of these two grasshoppers made predatism easier by the fact that groups of egg pods are deposited, for the most part, in the matted roots of isolated clumps of bunch grass where the pods are often interlaced. Also, the pods are sometimes laid parallel to and near the surface

of the soil. Eggs of other species of grasshoppers that are deposited earlier than these must provide food for early larvae, for these larvae may seek food often weeks before eggs of the differential and two-striped grasshoppers are laid.

Seven larval instars represent the full course of development. The first five are the necessary feeding instars, and the last two do not feed and are supernumerary. The first five instars and the seventh are as active as other common forms of subsurface larvae. The sixth instar, also known at the coarctate, is incapable of motion of any sort, is encased in a tough, unyielding, reddish-brown cuticula, and all appendages including the mouthparts are atrophied.

Primary Larva. The description of the morphological details of the primary larva of the black blister beetle (2) applies in general to this species as well. It is much larger than the same instar of the black blister beetle and may be considered large in comparison with most common species. Its head width is 0.610 ± 0.015 mm. Larvae in this instar are reddish-brown with the dorsum of the prothorax and of abdominal segments 6, 7, and 8 darker brown.

Primary larvae remain one or more days in the egg cavity before they all burrow out and disperse over the surface of the soil and begin their search for grasshopper eggs. Most of those that are successful find food within the interval of ten days after dispersion. Under favorable conditions, some may live 20 days without food. During the peak of the hatching season in late August and early September, primary larvae of this species may be readily seen crawling about over the ground. Three primary larvae were seen at one time on an area of three square feet at one especially favored oviposition site.

Larvae seem to find grasshopper egg pods in a haphazard manner by drilling into the soil directly and by prying into cracks and under surface debris. The successful few that find egg pods enter them wherever they strike the pod. More often the entrance is along the side of the pod rather than through the froth cap. Oviposition habits of the differential grasshopper favor lateral entry becaues the egg pods are usually in a horizontal position.

Feeding begins as soon as eggs are found. At first a larva inserts its sickle-shaped mandibles causing the fluid contents of the eggs to exude into the closely appressed mouth of the larva. As the egg contracts, the larva expands correspondingly. Sometimes the contents of two eggs are required for the first meal. Larvae expand and become crescentic and incapable of much motion because of the pressure of imbibed egg contents. If the temperature is

optimum, a larva in this instar is replete within one or two days and may molt within two to seven days. Under less favorable fall temperature, feeding requires a much longer time.

Later Feeding Instars. Four feeding instars follow the first instar or primary larva. These are very similar in general appearance to those of the black blister beetle (2). All four are similar and progressively larger having head widths of 0.759 ± 0.022, 1.041 ± 0.010, 1.471 ± 0.012, and 1.950 ± 0.017 mm. for the second, third, fourth, and fifth instars respectively. Those reared under laboratory conditions followed one another in rapid succession with instars 2, 3, and 4 lasting one to three days each. Even the feeding part of the fifth instar was completed in two days. The remainder of the fifth instar was spent in part burrowing about in the soil and in part as a quiescent larva resembling a prepupa. Larvae reared in the laboratory require about 16 days from the time the eggs are supplied until all five feeding instars have been completed.

Under field conditions, many of those larvae that find suitable food in June or early July develop rapidly through the first five instars and upon molting the fifth time, pass into the pupal stage and become adults the same season. The remainder of these early ones pass into the coarctate form and remain dormant until the next year. All of those completing their feeding in August and early September likewise become coarctate larvae and overwinter as such. A third group that begins feeding late develops slowly through fall and early winter and usually winters as partially fed larvae in the fifth instar. These late ones become coarctate larvae in the spring. Coarctate larvae that pass the winter change to the seventh instar and pupate in the spring. Larvae that become coarctate in spring change to the seventh instar in late summer and pupate normally. Some of these may not molt until the year following if conditions are unfavorable.

Non-feeding Instars. Larvae in the coarctate form are very resistant to dessication, and under circumstances of extreme drought, this form provides the means for survival. Fortunately for the species coarctate larvae may survive two or even three years before further development need take place, but with each succeeding year, the percentage of survival decreases markedly. This stage is not necessary for winter survival in this latitude as larvae in the fifth instar pass winter without noticeable ill effect. That it is not an essential stage in development is shown by the fact that the instar may be omitted under some conditions. This form guarantees survival of the species but is not important in the development of the individual. In this respect, the development of this beetle is similar to that of the black blister beetle (2).

A return from the seventh instar to coarctate form has been

occasionally observed in laboratory rearing. Always the reversion occurs when a larva in the seventh instar is subjected to abnormally dry conditions. In such cases, the larva shrinks a bit in size and the second coarctate form is smaller than the first one. Regular development follows if favorable moisture conditions are maintained. When a reversion occurs nine instars (four of which do not feed) are required for completion of the larval stage.

Table I below shows the duration of the larval instars as observed in an incubator which was kept at a temperature of about 80° F.

Table I. Duration of larval stage at about 80° F.

Instar	Number of larvae	Duration in days Maximum	Minimum	Mean
First	40	7	2	3.5 ± 0.2
Second	40	3	1	1.6 ± 0.1
Third	40	3	1	1.5 ± 0.1
Fourth	40	3	1	1.8 ± 0.1
Early fifth	40	2	2	2
Total feeding	40	13	8	10.5 ± 0.2
Late fifth	40	9	4	6.1 ± 0.2
Total 1-5 instars	40	19	14	16.5 ± 0.2
Sixth		Indefinite	Indefinite	
Seventh	20	24	11	15.6 ± 0.6

In the outdoor cages 36 to 38 eggs of the differential grasshopper were required for development, and the mean number consumed by 28 larvae was 37.3 ± 0.1 eggs. Since an egg pod of the differential grasshopper contains 100 or more eggs, two or three larvae may develop to maturity in a single egg mass at different times. Larvae will not feed peaceably together, but often two or more may feed at different places or at different times in the same egg pod. Frequently a part of the eggs is left uninjured.

PUPAL STAGE. Pupae are whitish when first formed and become progressively blacker beginning with a blackening of the eyes. They are always found in the soil in a nearly vertical position with the head upward. The stage is of short duration requiring about ten to 15 days for completion. It has never been found during the winter.

SEASONAL HISTORY

Adults begin to appear in late May and early June at the time of the flowering of the western daisy, and they may be collected from then until early October. These do not appear as broods, although they represent parts of two generations. Weekly records of sweeping in selected alfalfa fields show that adults were most abundant

during June and July in 1940 and 1941. This long period of adult abundance is accounted for by an extended period of emergence and not by excessive duration of adult life. In fact, adults live only four to six weeks.

The seasonal history is presented in Table II below.

Table II. Seasonal History

Month	Jan.	Feb.	Mar.	Apr.	May	June
Stage	5-6	5-6	5-6	67P	67PA	67PAE
Month	July	Aug.	Sept.	Oct.	Nov.	Dec.
Stage	67PAE1-5	PAE1-6	AE1-6	1-6	1-6	4-6

Note: Numbers 1-7 equal larval instars. P equals pupa. A equals adult. E equals egg.

Hibernating forms and active larval forms are found every month in the year in this latitude.

SUMMARY

The squash blister beetle was a pest of importance in gardens in northwestern Arkansas in the summer of 1939 and was one of less importance in 1940. Gardens surrounded by or bordering on meadow land adjacent to open woods were more often infested than those in other situations. In all localities where the differential and two-striped grasshoppers abounded, infestation reached serious proportions.

This blister beetle has been called the squash blister beetle because it is the most common species attacking fruits of squash varieties. Flowers of several species of cucurbits and those of alfalfa and the western daisy are preferred sources of food. Ripe tomato fruits are also injured by this species.

This may be considered a summer species because the adults occur all summer.

One and a partial second generation occur during outbreak years. Development may be rapid or delayed depending on whether feeding begins in summer or fall. True hibernation is not essential in this latitude. Quiescent (coarctate) larvae may be found every month in the year, and some may delay further development two or even three years. When the soil becomes abnormally dry after a larva has changed to the seventh instar, it may revert to the coarctate form until surrounding conditions are favorable for further development.

LITERATURE CITED

(1) Gilbertson, G. I. and Horsfall, W. R. 1940. Blister beetles and their control. South Dakota Agr. Exp. Sta. Bul. 340, 23 pp.

(2) Horsfall, W. R. 1941. Biology of the black blister beetle. Ann. Ent. Soc. America 34: 114-126.

(3) Say, T. 1824. **M. conferta.** Jour. Philadelphia Acad. Nat. Sci. 3: 282

VOL. 15 JOURNAL KANS. ENT. SOC., JULY, 1942 NO. 3

SOME NEW AMERICAN RHOPALIDAE (HEMIPTERA)

H M. HARRIS, Ames, Iowa

The following characterizations are presented at this time in order to make the names available for use in other manuscripts. The proportions are given in units, twenty-four of which equal one millimeter.

Stictopleurus knighti, sp. nov.

Size and form of S. **punctiventris** (Dallas), the color generally more roseate than in that species.

Male: Head flat above, rugosely punctate, broader than long (38:30), the preocular portion with sides parallel to apex of antenniferous tubercule. Antennae moderately long, segment I swollen distally, projecting beyond apex of head by more than half its own length, II and III fairly stout, linear, IV one-half longer than distance between eyes (35:23); proportion of segments, 14:29:27:35. Bucculae not quite embracing basal half of first rostral segment. Rostrum just attaining apex of intermediate coxae, segment I not quite extending to base of head; proportion of segments, 19:18:14:15. Pronotum with punctures, impressions, and pubescence about as in **punctiventris** (Dallas), the cicatrices forming complete loops laterally, the ridge anterior to them narrow and impunctate; sides slightly sinuate, the disc perhaps not so strongly raised posteriorly as in **punctiventris**; median length equal to three-fifths of width across humeri (30:50), the over all length equal to width of front lobe across cicatrices (35). Scutellum about as broad as long, strongly punctate, distinctly impressed or cupped on distal portion, the apex angular, its extreme tip sub-truncate. Hemelytra with base and exocorium coriaceous and punctate. Legs fairly stout, the femora speckled, the posterior ones black within except at base and apex. Metapleuron characteristic of the genus. Venter impressed each side of mid-line at base. Genital capsule more strongly produced at the mid-line beneath than in **punctiventris**, the parameres relatively flat, not conspicuously recurved and not bulbous at base as in that species. **Length**: 6.6-7.0 mm. **Width**: (pronotum) 2.08 mm.

Female: Proportionally larger than male. Head width, 42 units; pronotal width, 58 units. Antennal proportions about as in male. Apical segment of abdomen broadly rounded above; beneath laterally compressed so that its hind margin as seen from the rear is broadly V-shaped. Ovipositor and genital segments visible, though retracted within the apical segments of venter. **Length**, 7.7-7.9 mm. **Width**, 2.38 mm.

Holotype, male, and **allotype**, female, Kawishiwi River, Minnesota, August 28, 1919, H. H. Knight (in author's collection). **Para-**

types, 16 males and females, Kawishiwi River, Minn., Aug. 26-30, 1919; Polk Co., Minn., Aug. 11, 1936, R. H. Daggy; Mille Lacs Co., Minn., June 19, 1936 W. A. Riley; Carlton Co., Minn., May 19, 1936, P. M. Schroeder; Itasca Park, Minn., Aug. 11, 1937, R. H. Beamer; and Cloquet, Minn., Sept. 8, 1936, H. R. Dodge (in collections of H. H. Knight, University of Minn., University of Kansas; U. S. National Museum, and author).

The darker markings are variable, as in other Rhopalini, and in some of the specimens the connexivum is distinctly maculate. In all the individuals at hand there is a more or less uniform pale spot in the form of an inverted Y, extending back on the next to last dorsal segment. The apical segment is pale with an elongate oval black spot on its disc. The species is named in honor of Dr. Harry Knight and has stood in my collection under the name **knighti** for the past ten years.

Arhyssus **barberi**, sp nov.

Related to A. **scutatus** (Stal), and heretofore confused with it in most collections, but recognized by its much larger size, more flattened vertex, different body proportions, the nature of vestiture and sculpture, and the characters of the scutellum and genitalia.

Elongate oval, the sides more or less parallel. Yellowish testaceous with brown to black markings. Head one-fifth broader than long (42:35), rugosely punctate above; the vertex relatively flat, its width (26) slightly less than distance from ocelli to apex of tylus as seen from above. Antennae moderately long, segment I distinctly swollen before the middle, barely attaining apex of head; proportion of segments, 10:30:26:31. Antenniferous tubercules, as seen from the side, stout, not produced. Lorum faintly widened anteriorly, the apex truncate. Bucculae high, tapering, embracing slightly more than half of first rostral segment. Rostrum barely attaining posterior coxae, segment I just reaching base of head; proportions, 21:22:14:18. Pronotum much broader than long (60:35); gradually tapering anteriorly, the sides very feebly sinuate behind the cicatrices, the disc uniformly punctate, with a more or less distinct median longitudinal line which is raised and prominent along the interlobe area. Scutellum with distinct pale median line, as broad as long, the sides concavely sinuate slightly behind middle, the apical part pale, broadly rounded, almost flat across tip. Hemelytra with reddish-brown dots on the nervures. Legs fairly stout and hairy, distinctly speckled. Ostiolor opening large, placed low between intermediate and posterior coxae. Metapleuron broad, the posterior area not coarsely punctate, its hind margin not strongly oblique. Venter pale, in darker specimens with an obsolete broad lateral stripe. Genital capsule of male with the dorso-lateral edge in-

flexed, the median ventral portion broadly produced between the claspers, the latter slender, their tips curved. Lateral plate of female genitalia obliquely produced backwards as a flattened digitiform process. **Length:** male, 7.5-8.0 mm.; female, 8.0-8.5. **Width** of pronotum: male, 2.5; female, 2.9 mm.

Holotype, male, and **allotype**, female, Moscow mountain, Idaho, July 20, 1938, H. M. Harris (in my collection). **Paratypes**, many males and females, Moscow mountain, Idaho, various dates; Troy, Idaho, Aug., 1938, H. M. Harris; Kendrick, Idaho, August, 1938, H. M. H.; Parma, Idaho, Sept. 10, 1926, C. W. Wakeland; (in collections of U. S. National Museum; Univ. of Kansas; Ohio State Univ.; Calif. Acad. Sci.; Oregon State College, Univ. of Idaho; and Iowa State College.) Specimens also are at hand from Corvallis, Ten Mile, Dilley, Hood River, and Lane County, Oregon; Richfield, Utah; Lucerne, Fresno, Redding, and Giant Forest, California; and Yakima, Pullman, Dayton, Tampico, and Mt. Adams, Washington.

As stated above this species has heretofore been confused with **scutatus** (Stal.) and stands in many collections under that name. The basic color pattern of the abdominal disc is that pictured by Hambleton for **scutatus**.

It is named for Mr. Harry G. Barber who has had an abiding interest in this difficult group of bugs and who has helped me in many ways in my studies of them.

Arhyssus usingeri, sp. nov.

Recognizable by its small size, slender form, long head, long rostrum and the characters of scutellum, metapleuron, and genitalia.

Color yellowish to reddish testaceous, speckled with brown, the abdomen above pictured with black. Head only slightly broader than long (24:22), punctate and pubescent, the vertex (14) arched. Antennae short, segment I distinctly not attaining apex of head, IV stoutest, not quite four times as long as thick; proportion of segments, 7:10:10:15. Rostrum long, extending on second segment of venter, segment I about attaining base of head; proportion of segments, 13:15:11:11. Buccuale low, tapering, reaching to about middle of head. Pronotum rather thickly and uniformly punctate, with fine, semi-erect pale pubescence, broader than long (30:18), the sides nearly straight. Scutellum small, the apex pointed. Veins of hemelytra speckled, with pale semi-erect pubescence. Membrane about attaining apex of abdomen. Legs short, pubescent and setose. Sternum darkened, with longitudinal sulcus. Metapleuron bipartite, the hind margin of posterior portion strongly concave. Venter feebly sulcate at base for reception of rostral tip, the hind margin of last segment as seen from the side strongly concavely sinuate in male, feebly so in female. Last dorsal segment broadly rounded in male,

more narrowly rounded in female, ciliate. Male clasper strap-like, recurved, pointed; genital capsule with a knob on upper lateral edge. **Length**: 4.0-4.7 mm. **Width**: 1:25-1.50 mm.

Holotype, male, and **allotype,** female, Pine Canyon, Mt. Diablo, California, May 23, 1937, on **Salvia mellifera**, R. L. Usinger (in Calif. Acad. Sci.). **Paratypes,** males and females, taken with types, and at Niles Canyon, Alameda Co., Calif., May 26, 1928, R. L. Usinger; Salinas, Calif., Apr. 26, 1908, E. D. Ball; Claremont, Calif., July 29, 1935, R. H. Beamer; San Bernardino Co., Calif., May 1, 1923, W. Benedict; San Jacinto Mts., Calif., June 30, 1933, R. H. Beamer (in collections of Calif. Acad. Sci., U. S. Natl. Museum, Univ. of Kansas, R. L. Usinger, and author).

The Claremount specimens are uniformly paler and larger than the Mt. Diablo examples. The species is named for Dr. R. L. Usinger, who recognized the species as new and sent me a long series now some three years ago.

Arhyssus crassus, sp. nov.

Closely allied to A. **barberi**, sp. nov., but recognized by its more obovate form, slightly smaller size, more orange-yellow color, the coarser punctures and vestiture, and the characters of head, scutellum, and genitalia.

Head longer than broad (40:34), more strongly setose and more coarsely punctate than in A. **barberi**, the vertex (27) more definitely arched. Eyes smaller than in **barberi**. First antennal slightly swollen toward middle, just attaining apex of head; antennal proportions, 10:25:20:25. Antenniferous tubercules as viewed from above slightly more produced than in **barberi**. Rostrum attaining hind coxae; proportion of segments, (20:22:17:21). Pronotum much broader than long (60:35), more corasely and irregularly punctate than in **barberi**. Scutellum usually somewhat more broadly rounded apically and much more distinctly cupped or excavated on apical portion than in **barberi**. Abdomen widened to beyond middle. Venter usually with broad sub-lateral dark stripe. Genital capsule of male about as in related species, the produced median basal portion narrower than in **barberi**, the claspers more slender, their apices less recurved. Lateral plates of female genitalia with the produced part shorter. **Length**: male, 7.2-7.4 mm. female, 7.4-8.0 mm. **Width**: pronotum, 2.3-2.7 mm.; abdomen, 2.7-3.7 mm.

Holotype, male, and **allotype** female, Troy, Idaho, July 16, 1938, H. M. Harris (author's collection). **Paratypes**, males and females, Troy, Idaho; Moscow Mt., Idaho, July 20, 1933, H. M. Harris; Lenore, Idaho, May, 1938; Parma, Idaho, Aug. 21, 1925; Lewiston, Idaho, Apr. 28, 1936, V. E. Nygren; Moscow, Idaho, Oct. 3, 1931, Paul Rice;

Grangeville, Idaho, June 20, 1938, Harris and Shull; Pullman, Washington; Puyallup, Washington; Yakima Washington; Blewett, Washington, May 24, 1931, F. P. Dean; Wawawai, Washington, May 20, 1911; Biggs, Oregon, July 16, 1931, R. H. Beamer; Weston, Oregon, April 28, 1938, Schuh and Gray; Lake View, Oregon, July 27, 1930, H. A. Scullen; Corvallis, Oregon, Mar. 11 , 1935, Hood River, Oregon. July 17, 1931; Haines, Oregon, July 10, 1931, J. Nottingham; Palo Alto, California, Apr. 6, 1892; Taft, Calif., Aug. 5, 1937; Cuyama Ranch, Calif., July 25, 1935, R. H. Beamer; Claremont, Calif., Baker; Provo Bench, Utah, D. E. Beck; National Park, Wyoming, Oct., 1891 (in collections of U. S. Nat. Museum, Univ. Kansas, Oregon State College, Washington State College, Brigham Young Univ., University of Idaho, and Calif. Acad. Sci.).

This species has been much confused with **Arhyssus scutatus** (Stal) and A. **barberi** n. sp. It is distinctly larger than the former. Among the many slight differences that serve to distinguish it from **barberi** are its less strongly swollen first antennal segment, and the more prominent punctures on apical third of scutellum. The apical antennal segment is not so stout and is more gradually enlarged from the base.

Arhyssus **brevipilis**, sp. nov.

Belonging to the **scutatus-indentatus** group of species, but at once recognizable by the short, appressed pubescence.

Head, broader than long (34:27), coarsely punctate, with a few scattered setae toward apex, elsewhere with short, appressed silvery pubescence. Antennae moderately long, segment I stouter than in **indentatus** (Hambleton), slightly surpassing apex of head, the hairs of segments II and III not longer than diameter of segment; proportion of segments 11:20:18:23. Bucculae high, extending to apical fourth of first rostral segment. Rostrum reaching beyond middle of metasternum, segment I not quite attaining base of head; proportion of segments, 17:15:11:14. Pronotum broader than long (45:27), coarsely punctate, with short appressed pubescence, not setose, the impressed smooth lines in front rather distinct, the disc noticeably transversely constricted in front of middle. Scutellum not so broadly rounded apically as in **indentatus**; the lateral edges raised, constricted just behind middle, the disc of apical part concave. Hemelytra with nervures speckled with brown, the clothing hairs very short and semi-recumbent; membrane just attaining apex of abdomen. Body beneath with clothing hairs shorter and of different character than in **indentatus**. Metapleuron with hind margin a little more concavely sinuate than in related species. Legs speckled, distinctly less setose than in **indentatus**. Clasper slender. **Length:** 5.5-5.9 mm. **Width** of pronotum: 1.7-1.9.

Female: Slightly broader than male, the scutellum more broadly rounded. Rostrum just attaining base of venter, first segment almost reaching base of head. Apical segments of abdomen more sharply rounded than in male, the upper margin ciliate. Lateral plate of genital segment produced apically. **Length:** 5.7-6.1 mm. **Width:** 1.9-2.1 mm.

Holotype, male and **allotype**, female, Moscow Mountain, Idaho, July 20, 1938, H. M. Harris (in my collection). **Paratypes**, males and females, Moscow Mountain, Idaho; Kendrick, Idaho, July 13, 1938, H. M. Harris; Kootenai, Idaho, July 8, 1938, H. M. H.; Yakima, Washington, June 10, 1930, A. R. Rolfs; Signal Pk., Washington, July 4, 1930, A. R. Rolfs; Parkdale, Oregon, June 23, 1938, K. Gray.

Some of the specimens have shorter antennal and rostral segments and stouter first antennal segment than the type.

ZINC OXIDE: A NEW LARVICIDE FOR USE IN THE MEDICATION OF CATTLE FOR THE CONTROL OF HORN FLIES

W. G. BRUCE,
U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine

The successful internal medication of cattle for the purpose of rendering their droppings unsuitable for the development of larvae of the horn fly, **Haematobia irritans** (L.), was visualized by Gallagher (1928) and later realized by Knipling (1938). Subsequent experimentation by the writer (1939, 1940) involved 68 tests with 29 chemicals. Some of these chemicals proved effective, but they were either too expensive or had some undesirable features that made them unfit for general use. The most effective chemical tested was rotenone, fed daily at the rate of 0.3 gram per 100 pounds body weigth of the animal. Another chemical, phenothiazine, was effective in daily doses of 1 gram per hundredweight, but it had the undesirable effect of imparting a reddish tinge to the milk of cows.

Experiments were continued in 1940 and 1941 in an effort to find a chemical that would be toxic to larvae of the horn fly, harmless to cattle, inexpensive, and commonly available. Zinc oxide appears to meet these requirements.

Zinc oxide (ZnO) is a very fine, odorless, tasteless, amorphous, white powder. The following is quoted from Wood and LaWall (1937):

> "Zinc oxide has been used as an antispasmodic in chorea, epilepsy and whooping cough . . . It is also sometimes employed for its astringent and sedative properties in diarrhea.

Its most important use, however, is as an application to excoriated surfaces and in various skin diseases. It owes its popularity to a combination of four qualities: it is non-toxic, protective, mildly astringent and probably antiseptic."

Procedure

The experimental cattle were confined in a screened building and fed a ration of bran and prairie hay. After the cattle had been given dry feed for 2 days they were fed zinc oxide (U.S.P.) mixed with moist bran. A sample of the dropping collected within 1 hour prior to medication was used as a check. The animals were medicated at 4 p. m., and droppings were collected at approximately 8 a. m. and 4 p. m. each day thereafter for as many days as the test was in progress. A sample of approximately 500 grams of the droppings from each collection was placed on 800 grams of moist sand in a pan and infested with 100 horn fly eggs. Each sample was kept in an individual 18-mesh screen cage in the insectary, and the emergence of flies therefrom was recorded.

Results

Zinc oxide in the droppings had no ovicidal qualities, as indicated by the hatch of 11,120 of the 11,700 horn fly eggs used in these tests, an average hatch of 95.04 per cent.

The dose of zinc oxide for six animals tested ranged from 1 gram to 3 grams per 100 pounds body weight of the animal. The minimum dose necessary to prevent development of horn fly larvae in the droppings was 1.5 grams per hundredweight. Three doses of 10.5 grams each (1.5 grams per hundredweight) administered at daily intervals to a 700-pound steer were effective for 3 days, beginning about 20 hours after the administration of the first dose, and 75 per cent effective on the fourth day. Twenty doses of 4.5 grams each (1.5 grams per hundredweight) administered at daily intervals to a 300-pound heifer were effective for 20 days, beginning about 20 hours after the administration of the first dose, and showed some larvicidal effect for 2 days after the last dose was administered. It is evident from these two tests that a dose of 1.5 grams of zinc oxide per hundredweight was an effective larvicide for approximately 24 hours.

The test animals never hesitated in eating the bran containing zinc oxide, and they remained in good condition throughout the tests.

Treatment of Droppings

To determine the quantity of zinc oxide necessary to render cattle droppings toxic to horn fly larvae, when the chemical was mixed directly with the droppings, a number of tests were made in

which from 0.0003 gram to 1.0 gram of zinc oxide to 100 grams of droppings was used. The method was to mix 800 grams of droppings in an electric mixer for 15 minutes. From this original mixture 400 grams were taken for use as a check sample. To the remaining 400 grams of dropping the zinc oxide and an additional 400 grams of dropping were added, and the mass stirred in the electric mixer for another 15 minutes. This procedure of mixing and halving the samples, without the addition of more zinc oxide, was repeated as necessary. These tests were made in two series, one series containing from 0.015 to 1.0 gram of zinc oxide to 100 grams of droppings and the other containing from 0.0003 gram to 0.08 gram of zinc oxide per 100 grams of droppings. Each sample dropping was infested with 100 horn fly eggs and placed on moist sand in an individual screen cage for observation on adult emergence. The average hatch of eggs used in these tests was 96.4 per cent. The minimum lethal concentration of zinc oxide was 0.01 gram per 100 grams of droppings. Ten tests with 0.01 gram or more per 100 grams of dropping gave 100 per cent control. Some larvae developed in each of six samples of droppings containing zinc oxide in the amount of 0.005 gram or less per 100 grams of droppings. This minimum lethal concentration of 0.01 gram of zinc oxide per 100 grams of droppings is equivalent to 0.2 pound of zinc oxide per ton of droppings.

Summary

Experiments were conducted to determine the value of zinc oxide in preventing the development of larvae of the horn fly, **Haematobia irritans** (L.), in cattle droppings. When various quantities of the chemical mixed with bran were fed to cattle, the minimum effective dose was 1.5 grams per 100 pounds weight of the animal. This dose rendered the droppings unfavorable for the development of horn fly larvae for 24 hours, beginning 20 hours after administration. When zinc oxide was mixed directly with the droppings, the minimum lethal dose was 0.01 gram for each 100 grams of droppings.

LITERATURE CITED

Bruce, W. G 1939 The use of phenothiazine in the medication of cattle for the control of horn flies Jour Econ Ent 32(5) 704-706 October

Bruce, W G. 1940 The medication of cattle for the control of horn flies. Jour Kans Ent Soc. 13(2) 41-3 April.

Gallagher, B A 1928 Special report on horn fly experiment. Hawaii. Forester and Agr 25(3): 144-6.

Knipling, E. F 1938 Internal treatment of animals with phenothiazine to prevent development of horn fly larvae in the manure Jour. Econ Ent 31(2): 315-6 April

Wood, H. C., and LaWall, C H 1937 Dispensatory of the United States of America, 22nd (Centen) Ed., p 1204 J B. Lippincott Co, Phila

DAMAGE TO KERNELS OF WHEAT BY HARPALUS AMPUTATUS SAY,* IN WESTERN KANSAS

ROBERT E. BUGBEE[1]

On October 10, 1941, Mr. A. R. Hanks of Dighton, Kansas sent to the Zoology Department of Fort Hays Kansas State College several live specimens of a ground beetle which proved to be **Harpalus amputatus** Say. Accompanying the beetles were several kernels of wheat which showed evidence of having been gnawed or chewed. More than half of the kernel had been eaten in some cases. According to Mr. Hanks, it was the work of the beetle mentioned above. Live specimens kept in captivity readily gnawed kernels of wheat. The sender stated that the beetles were doing considerable damage to shallowly-sown wheat in the neighborhood of Dighton and seemed to be present in enormous numbers. He estimated that about fourteen years ago a similar attack, by what he thought was the same species, occurred.

On checking with Mr. R. T. Cotton of the Bureau of Entomology and Plant Quarantine, stationed at Manhattan, Kansas on possible previous records of similar damage by **H. amputatus**, information by letter stated that he did not know of any previous records of phytophagy for this species in Kansas. The species is mentioned, however, several times in "Lists of Coleoptera," for Kansas by Popenoe (1877), Colorado (Snow, 1877) and New Mexico (Snow, 1881). Thus it has been known for more than 65 years but this appears to be the first record of a phytophagus habit in Kansas.

Phytophagy in other members of the family, including the genus **Harpalus**, has been recorded by several authors. Thus by letter Mr. Cazier states, "many of the members of this genus feed on seeds of wild plants." Blatchley in "Coleoptera of Indiana" (1910) lists **Harpalus caliginosus** Fab. and **H. pennsylvanicus** Dej. as feeding on seeds of ragweed in addition to caterpillars and other insect larvae.

*Kindly identified by Mr. Mont A. Cazier of the American Museum of Natural History. New York.

[1]Contribution No. 43 from the Zoology Department of Fort Hays Kansas State College, Hays, Kansas.

LITERATURE CITED

1. Blatchley, W. S. 1910 Coleoptera of Indiana. Indiana Dept. Geol. Nat. Resources. Bull. No. 1: 1-386.
2. Popenoe, E. A. 1877. A List of Kansas Coleoptera. Trans. Kans. Acad. Sci., 5: 21-40
3. Snow, F. H. 1877. List of Coleoptera Collected in Colorado in June, July, and August, 1876, by the Kansas University Scientific Expedition. Trans. Kans. Acad Sci, 5: 15-20.
4. Snow, F. H. 1881. List of Coleoptera Collected in Santa Fe Canyon, New Mexico. Trans. Kans. Acad. Sci., 7: 67-71.

REPRINT PRICES

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

Pages	1-2	3-4	5-8	9-12	13-16	17-20	21-24	25-28
50 copies	$1.10	$1.40	$3.85	$5.25	$7.45	$ 9.65	$11.85	$14.05
100 copies	1.40	1.65	4.15	5.80	8.00	10.20	12.40	14.60
200 copies	1.65	2.20	4.95	7.15	9.35	11.55	13.75	15.95
100 Add'n'l	0.55	1.10	2.20	3.30	4.40	5.50	6.60	7.70

Tables—for setting up—$1.25 per page extra.

Covers, per 100—$2.50

Fifty copies of reprints are free to the authors provided at least 50 copies are purchased. Reprints should be ordered in lots of 50 or multiples thereof.

Postage or express charges on carriage of reprints are extra

PRICE OF BACK VOLUMES

Volume 1 .... $2.00
Volumes 2 to 7 inclusive 1.00
Volumes 8 to date 1.50

Subscriptions for back volumes or numbers should be sent to Donald A. Wilbur, Entomology Department, Kansas State College, Manhattan, Kansas.

CONTENTS OF THIS NUMBER

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

A quarterly journal published in January, April, July and October devoted to Entomology in the Western Mississippi Basin and the proceedings of the Kansas Entomological Society.

Manuscripts for publication may be sent to any of the publication committee.

The Kansas Entomological Society does not make exchanges since the Society does not maintain a library.

Subscription to the Journal must be paid in advance. The subscription rate is so low that second notices are not ordinarily sent out.

Payment of Canadian or other foreign subscriptions and bills must be made by international Postal Money Order or by a draft on a New York bank and payable in U. S. A. dollars.

Subscribers are urged to give us their full cooperation in these matters.

Subscriptions should be sent to Donald A. Wilbur, Entomology Department, Kansas State College, Manhattan, Kansas.

Subscriptions in the U. S. A.,	**$1.50 per year**	**Single Copy**
Canadian or foreign subscriptions,	**1.75 per year**	**60 cents**

Vol. 15, No. 3, July, 1942

VOL. 15 OCTOBER, 1942 NO. 4

Journal

OF THE

Kansas Entomological Society

PUBLICATION COMMITTEE
PAUL B. LAWSON, Editor, Lawrence
R. H. BEAMER, Lawrence R. H. PAINTER, Manhattan
DWIGHT ISELY, Fayetteville, Ark.

JAMES WALKER McCOLLOCH
1889-1929

Entered as second-class matter June 7, 1939 at the Post Office at Manhattan, Kansas, under the Act of August 24, 1912

Kansas Entomological Society
Volume 15 October, 1942 Number 4

EMERGENCE HABITS OF THE CLEAR LAKE GNAT

ARTHUR W LINDQUIST and CHRISTIAN C. DEONIER
U. S Department of Agriculture, Bureau of Entomology and Plant Quarantine

In connection with studies on the biology and control of the Clear Lake gnat, **Chaoborus astictopus** D. and S., which breeds in the waters of Clear Lake, Lake County, Calif., special attention was given to the emergence of the insect from the lake. Information was desired on the daily and seasonal rates of emergence, sex ratio, cycles of activity, and the time of day at which emergence was most frequent, all of which have a bearing on control.

Herms (1937) reported that the pest breeds in Clear Lake and surmised that emergence begins early in the afternoon. Local residents and others asserted that swarms of gnats could be seen emerging or "hatching" out of the water near the shore. The sudden dip and rise of swarms over the water at dusk does give the impression that the insects are issuing directly from the lake. Frequent sampling, however, showed that these swarms were composed almost entirely of females. Furthermore, dissection of representative specimens of these females disclosed mature eggs, which were not found in newly emerged specimens.

METHODS

It was thought that, if cages were placed over the water, information on emergence could be obtained. After several trials with different types and sizes of cages, a floating pyramidal cage was developed. The cage is made of 18-mesh screen wire, is open on the bottom, and covers 9 square feet of water surface. The top is fitted with a wide-mouth quart Mason jar containing a cone into which the gnats are driven when the cage is covered with a dark-colored hospital rubber sheeting. The jar can be unscrewed and replaced. The cages are anchored by means of a rope and weight. The pupae come to the surface preparatory to adult emergence, and when the adults come up under the cage they are caught. However, the journey from the bottom mud is not made rapidly, and the effect of currents and the swimming of the pupae does not mean that all the insects coming up into the cage originate in the mud directly beneath it. As a matter of fact, great differences were observed in the catches of the various cages, and it is evident that in many cases the pupae moved hundreds of feet horizontally before the adults emerged.

A few cages were operated at various distances off shore in the latter part of August and in September, 1938. A cage 220 feet off

shore showed little emergence, but cages farther out took various number of gnats. In 1939 a line of five cages (line A) was established at right angles to the shore near the upper end of the lake on the east side near the village of Nice. The first cage was approximately 1,000 feet off shore and the others were a little over ½ mile apart, making the fifth cage about 2½ miles off shore. A line of three cages (line B) parallel to line A was operated 3,000 feet down the lake. The cages in line B were placed in the same relative position as the first three cages nearest shore in line A. The emerged insects were taken out of the cages daily and brought to the laboratory. The cages were established April 26 and were continued in use until October 15. The cages in line A were operated throughout the seasons of 1939 and 1940. The average seasonal emergence from the first three cages in line A was 555 insects to the square foot and those in line B 580.

EMERGENCE IN CAGES IN LINE A, 1939-40

An outstanding finding was that throughout the two seasons in which the cages in line A were in operation emergence occured every day on which observations were made. There were 8 days in 1939 and 6 days in 1940 when storms prevented examination of the cages. A lack of well-defined generations is indicated by daily emergence and suggests that factors are operative which limit a steady development of the organism. From the point of view of control, an attack against the emerging insects would be a never-ending endeavor.

In table 1 is shown the monthly emergence from the various cages in line A. In 1939 the average monthly emergence from all the cages ranged from 48.9 gnats per square foot in May to 134.6 per square foot in July and in 1940 from 42.1 in May to 252.0 in August.

The daily emergence can be characterized as sporadic and irregular. The emergence per square foot has ranged from less than 1 to 75. A graph of the daily numbers taken is jagged and appears to have little significant regularity except as it relates one cage to another. The same characteristic has been found in gnats the larvae of which were taken in mud samples from the bottom and brought to the laboratory for emergence studies. From two lots of mud, each containing an estimated 200 larvae collected on June 1, 1939, 6 adults emerged.

At the end of 53 days many live larvae remained without having transformed. Similarly, on June 8, 19 adults emerged in one jar and 14 in another, and live larvae were recorded in both jars 45 days later. In these and similar tests the larvae were fed, but probably inadequately. On August 18 mud containing an estimated 800 larvae was placed in a 6-gallon jar and plankton was added frequently. A total of 130 adults emerged over a 41-day period, and during this

Table 1.—Emergence of **Chaoborus astictopus** in five cages in line A located from approximately 1,000 feet to about 2½ miles off shore on Clear Lake, Calif., 1939-40.

Date	Number of Gnats per Square Foot					
	Cage 1	Cage 2	Cage 3	Cage 4	Cage 5	Average
1939						
May	94.0	81.8	17.9	29.2	21.5	48.9
June	157.2	225.7	66.6	70.6	51.3	114.3
July	226.7	208.2	65.7	87.6	84.8	134.6
August	112.8	148.0	23.0	81.0	119.8	96.9
September	40.1	98.9	97.3	116.4	109.0	92.3
Total	630.8	762.6	270.5	384.8	386.4	487.0
Percent of total	25.9	31.3	11.1	15.8	15.9	——
1940						
May	39.3	54.4	48.8	26.8	41.1	42.1
June	66.0	113.9	101.7	52.1	91.2	85.0
July	182.9	252.5	116.2	81.3	107.2	148.0
August	382.9	429.8	143.8	41.9	261.8	252.0
September	185.7	114.4	97.3	58.8	177.9	126.8
Total	856.8	965.0	507.8	260.9	679.2	653.9
Percent of total	26.2	29.5	15.5	8.0	20.8	——

time the water temperature ranged from 70° to 80° F. Live larvae were observed in the jar 5 months later.

Of special interest is the fact that cages 1 and 2 in line A, those close to shore, recovered the greatest numbers of gnats during both years. In 1939, 25.9 and 31.3 percent, respectively, of the total were taken in these two cages and in 1940, 26.2 and 29.5 percent. During short periods the emergence was less in these cages than in those farther out. The combined recovery of these two cages was 57.2 percent of the total in 1939 and 55.7 percent in 1940. This is remarkably consistent and is supporting evidence that the cages reflect actual conditions. Cages 3 and 5 showed somewhat similar percentages both years, but cage 4 took only 8.0 percent in 1940 and 15.8 percent in 1939. The monthly figures for the different cages varied somewhat, but in general a uniform consistency is manifest.

The large emergence in cages 1 and 2 is noteworthy when the record of the larval and pupal population in the bottom and in the vicinity of the cages is studied. In 1939 samples of bottom mud, into which the larvae and pupae retreat during the daylight hours, were taken twice a week with a 6-inch Ekman dredge at cages 1, 3, and 5. On a square-foot basis a total of only 150 pupae were taken during the season at cage 1, while 730 and 808 were recovered at

cages 3 and 5, respectively. Similarly, 8,044, 13,700, and 13,508 larvae were taken near these cages. The ratio of larvae to pupae in the three cages was 54.4 to 1, 18.8 to 1, and 16.7 to 1. It will be noted that the greatest emergence apparently occurred in the area of the lowest population and that the least emergence took place where larvae and pupae had been noted as abundant. Frequently at cage 1 no pupae were found, but large emergences nevertheless occurred. The explanation for this phenomenon is that, when the pupae leave the bottom mud during the night, they are transported by currents or exhibit a voluntary migration, seeking quieter or warmer water for emergence. Miller (1941) observed emergence of **Chaoborus punctipennis** at all depths in Costello Lake, Ontario, Canada. He states that "pupae may evidently stray or be carried far from their larval habitat." If currents are moving the pupae, the question arises as to why the larvae are not similarly transported with a resulting concentration close to shore.

That the mature larvae are scarce close to shore is evident from examination of thousands of bottom samples. It seems probable that pupae are less resistant to water currents than are mature larvae, and possibly the pupae keep moving until water or temperature favorable for emergence is found.

SEASONAL EMERGENCE

The emergence from the five cages in line A by half-month totals and the water temperatures at these cages during 1939 and 1940 are shown in fig. 1. In 1939 emergence reached its peak in the last half of July and in 1940 the peak was reached in the first part of August. In both years emergence declined following the peaks until the first part of October, when very few adults issued. The number of pupae taken twice monthly in bottom samples of mud at 15 stations over the lake showed a similar trend through the season; that is, more pupae were taken during the latter part of July and the first part of August than during May, June, and September. The dip in curves during the first part of July, 1939 and the last part of June, 1940 represents the decline of the overwintering generation. In 1939 the overwintering generation continued to emerge from April 24 to at least July 1, a period of 67 days. This was determined by studying bottom samples and noting the appearance of the new crop of larvae.

The finding that the emergence of the overwintering generation is a long-drawn-out process definitely limits a quick, decisive attack against the adults for control purposes. In 1940 the emergence of the overwintering generation could not be followed definitely later than June because of a heavy new crop of larvae. The prolonged

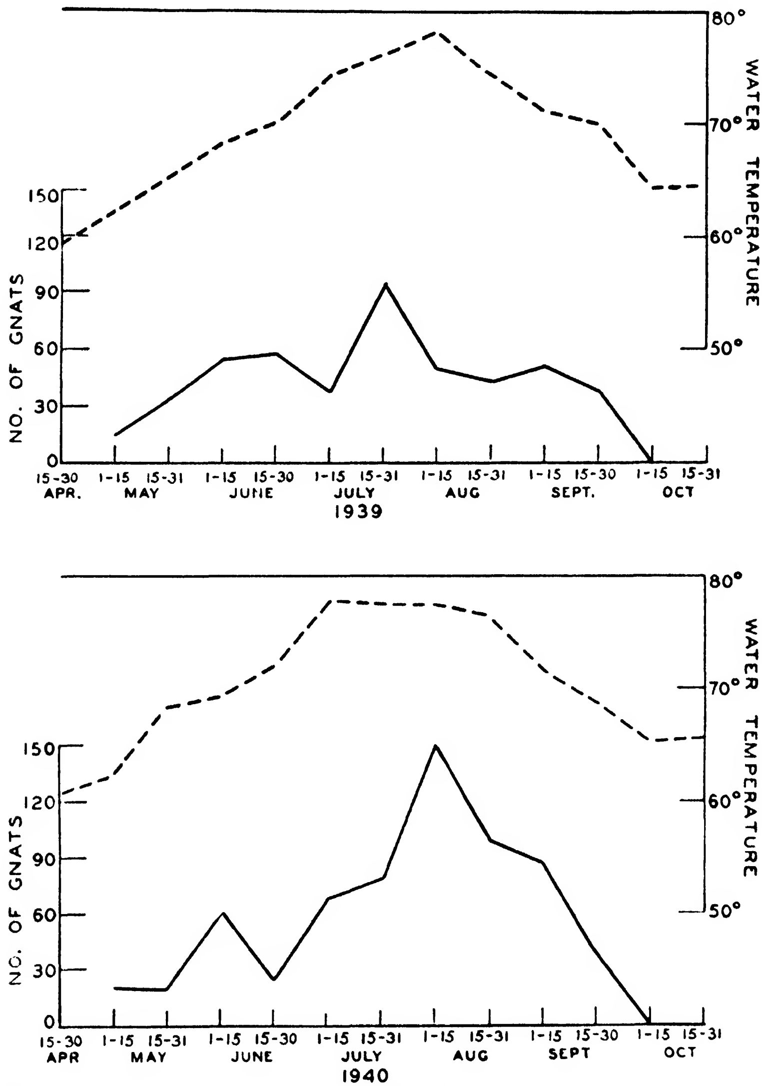


Fig. 1—Emergence of **Chaoborus astictopus** from five cages by half-month-totals, together with water temperatures, 1939-40.

period of emergence of the overwintering larvae can be attributed only to variations in food and temperature, although both factors appeared to be favorable. In the light of this long period and the absence of peak emergencies during the latter part of the season, the

conclusion is reached that the number of generations probably does not exceed 2 or 3, depending on the date of the first oviposition in the spring. There is of course much overlapping of generations. The life cycle can, however, be extremely rapid—from 14 to 20 days when larvae are fed to repletion in the laboratory.

A perplexing problem has been the decrease in emergence during the latter part of August and September, in spite of previous heavy oviposition. Heavy oviposition during the first part of August and also during the latter part of that month has not been followed by a large emergence or a notable increase in the number of the immature stages. This would seem to indicate either that egg laying is not sufficient to populate the lake, which does not appear likely, or that a heavy mortality of the immature stages occurs.

EFFECT OF WATER TEMPERATURE, AIR TEMPERATURE, AND STORMS ON EMERGENCE

A study of the water temperature in relation to emergence reveals that the gnats began issuing from the lake in measureable numbers in the spring of 1939 when the water temperature reached 62.2° F. In May and June the temperature of the water was below 70° until the last few days of June. Nearly one-third of the season's emergence took place during these months. In the middle of Septem- when the water temperature dropped to 70° the emergence had fallen off markedly and dropped to practically nothing when the water temperature reached 64.1°. The same trend of events occurred in September, 1938, when the emergence fell off considerably at 70° and practically ceased at 65°. The developments in 1940 were similar. It is interesting to note that **Chaoborus astictopus** emerged in the spring in large numbers at water temperatures of 62° to 70°, but in the fall pupation and emergence were greatly reduced at 70° and nearly ceased at 65°. It appears that some other factor or factors beside temperature causes the diminution in fall emergence. It is probable that the availability of larval food has a bearing on this phenomenon. In the spring the overwintering generations of larvae are all equal size or in the last instar, owing to growth during the fall and winter, and they are ready for pupation and emergence at comparatively low temperatures.

Eggleton (1932), in discussing **Chaoborus punctipennis** Say in Third Sister Lake, Washtenaw County, Michigan, has observed what appears to be a cessation of pupation and emergence in the fall. He states that "the full-grown larvae appear, even in late autumn, to be in the last larval instar, but are prevented from pupating by some factor or factors—perhaps the falling temperature of the water—present until spring when, perhaps owing to rising temperature, they

pupate and emerge in the first spring swarms." Eggleton attributes the failure of the grown larvae to pupate in autumn to unfavorable temperature, which may be a factor, but a perusal of the data on bottom temperatures of Third Sister Lake (Eggleton, 1931) shows the following for 1928: April 6, 40.6° F.; April 20, 43.2°; May 23 and June 6, 43.7°; October 10 and November 3 and 10, 45.7°. These figures show a gradual increase in temperature during the season with the warmest period in the fall. It appears that the increased temperatures should have accelerated pupation, but from the data available both species, namely, C. **astictopus** and C. **punctipennis,** appear to slow up or cease pupation in the fall, notwithstanding temperatures which appear to be favorable. Degree of availability of larval food and other factors probably contribute to this phenomenon.

In this connection an interesting comparison between the two species can be made. Eggleton states that larvae of **Chaoborus punctipennis** taken from the lake in the winter and warmed gradually to 59° to 68° pupated in 24 to 48 hours. C. **astictopus** taken from Clear Lake in October, November, and December and subjected to temperatures of 70° to 80° and fed plankton did not pupate for long periods. No pupation occurred in less than 20 days, and usually a much longer period was required.

Pupae have been recovered in Clear Lake by seining with large nets as early as April 15 at a water temperature of 58° F. In Blue Lake, a small neighboring body of water, **Chaoborus astictopus** pupae were taken in bottom samples of mud at the rate of 29.2 per square foot on May 6, 1940, when the water temperature was 52°. On May 8, in Clear Lake, pupae were found at the rate of only 6.4 per square foot at a water temperature of 62.3°. Under certain conditions it appears that pupae can form under the remarkably low temperature of 52°. Eggleton (1932) reported larvae of C. **punctipennis** pupating and emerging usually by the first week in April in Third Sister Lake. The bottom water temperature in this lake on April 6, 1928, was 40.6 F°. Muttowski (1918) states that C. **punctipennis** begins to pupate in Lake Mendota about June 10, and large swarms emerge continually from June 15 to August 20. The last adults emerge about September 30. It appears that this species has various habits in different lakes.

Air temperatures do not ordinarily have much direct effect on emergence of **Chaoborus astictopus** except insofar as they influence water temperatures. The insect issues from the lake during the coolest part of the day, and the usual minimum air temperatures of 48° to 58° F. apparently are not deleterious to flight. Lower temperatures, which are infrequent during the summer, occasionally

destroy the emerging gnats.

Storms with attendant heavy wave action no doubt affect emergence, although recovery of gnats in the cages has occurred after all-night blows. Unusually strong waves probably prevent emergence or destroy the issuing insects.

RATE AND TIME OF EMERGENCE AND SEX RATIO

As shown in table 1, the total seasonal emergence from the various cages in 1939 ranged from 270.5 to 762.6 gnats per square foot, with an average of 487.0, and in 1940 it ranged from 260.9 to 965.0 gnats, with an average of 653.9. These numbers are considerably less than might be expected. The larval population as determined by 33 bottom samples taken at 11 stations on April 26 averaged 920 larvae per square foot before appreciable emergence commenced and dropped to 84 on June 24. The difference of 836 should be represented by emergence, but during this time an average of only 163 insects per square foot, or approximately one-fifth of the larvae, were accounted for by recovery in the cages. This discrepancy is explained by certain facts. First, it was clearly established that great emergence occurred close to shore far removed from the observed larval and pupal concentration. The shifting of the pupal population away from this center toward the shore of the lake dispersed the insects over twice as large an area as the original; hence in the calculation of total emergence the entire water area must be considered. Furthermore, intermittent operation of the cages beyond cage 5 and also farther down the lake indicated a larger emergence which would increase the average.

Another explanation of the above discrepancy is that as the pupae near shore they become subject to attack by certain shore-feeding species of fish, with a consequent decimation of numbers. This phenomenon has been demonstrated by the finding of nearly as many pupae as larvae in the stomachs of the Sacramento perch, **Archoplites interruptus** (Girard), the calico bass, **Pomoxis sparoides**, (Lacepede), and, to a lesser extent, the blue-gill sunfish, **Helioperca incisor** (C. and V.).

Larvae are always many times more abundant than pupae in bottom samples as well as in net hauls out in the lake; hence the large proportion of pupae in the stomachs of these fishes indicate that the pupae were available for attack near shore. Thirdly, a continuous mortality of larvae occurs owing to fish predation, death from disease, and other causes. Dead larvae on the surface of the water are a frequent finding.

On the basis of the emergence represented by the fiv cages

in line A in 1939 the overwintering generation accounted for at least 163 gnats per square foot and the summer generation totaled 325, or twice the original overwintering population. This includes only the emerged individuals and does not take into account the larvae that did not produce adults, but overwintered. In 1940 the overwintering generation accounted for an estimated 127 per square foot and the summer generation totaled 535, or an increase of 4¼ times. In spite of the insect's high biotic potential it is evident that forces are operative to keep the multiplication low.

It is calculated that the total seasonal production on the upper, or larger, arm of the lake, comprising 44 square miles, on the basis of emergence from the five cages was approximately 531 billion gnats, or 266 tons, in 1939. The daily average was approximately 3½ billion, or 3,474 pounds. These figures represent the number of gnats actually recovered and perhaps is a minimum estimate because factors such as greater emergence in other areas and spiders in cages reduced the average. In 1940 the total production was computed to be 712 billion gnats, or 356 tons. The daily average was 4,655 pounds with a maximum of approximately 14 tons. The greater production in 1940 was due to heavy and frequent oviposition in May and June, which was brought about by above-average temperatures and much calm weather. In May and June, 1939 conditions were not favorable for oviposition.

One night's emergence of gnats (3½ billion) spread over the country-side would provide a high degree of infestation. If these should be spread evenly for a mile back of shore, there would be approximately 5 gnats per square foot, or, if figured on a cubic-foot basis, one-half gnat per cubic foot if they are extended equally up to 10 feet into the air. Sweepings with a net on a car over extended areas have shown that the cubic-foot population seldom exceeds 10, usually the average is from less than 1 to 1 or 2 per cubic foot. Concentrations along shore or around lights, of course, have greater densities.

Frequent examinations of the cages in the daytime and in the evening up to 11 P. M. did not disclose any emerged gnats. Examinations from 6 to 8 A. M. always showed insects in the cages. It was concluded that emergence occurs between 11 P. M. and 6 A. M.

Seining with a plankton net and the taking of samples at different depths with a Kemmerer water bottle during the evening hours revealed that larvae ascended from the bottom earlier than the pupae and that pupae were seldom recovered near the surface before midnight.

In July a series of cages were operated so that emerging insects were collected at various hours during the night. During an 11-day period the greatest emergence took place from 12 to 6 A. M.

The sex ratio of 7,044 individuals taken from the cages in 1938 showed 60.2 per cent males and 39.8 per cent females. In 1939, 20,-886 specimens showed an equal sex ratio. No sex-ratio difference was observed from different locations, but the daily ratio varied considerably.

EMERGENCE AT OTHER POINTS ON THE LAKE

Cages were operated intermittently at various places on the lake. Three series of three cages each were operated approximately equidistant off the east shore at Nice, Lucerne, and Russ Cove. All cages showed a progressively declining emergence away from shore, although this varied during short periods.

The location of the first five cages in line A and an extension of the line farther out into the lake and toward the west shore is shown in fig. 2. The emergence shown per square foot is during

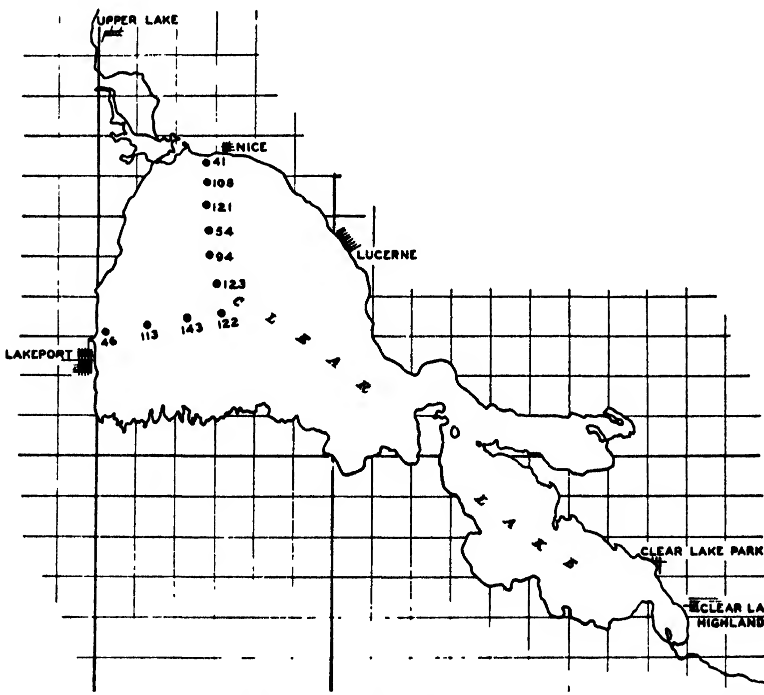


Fig. 2—Emergence of Chaoborus astictopus per square foot in cages during the period June 14 to July 11, 1940.

a 28-day period in June and July, 1940. This and other temporary cage settings indicate that emergence occurs over the entire lake area.

SUMMARY

Floating cages were used to study the emergence of **Chaoborus astictopus** from Clear Lake, Calif. Records from a line of five recovery cages on the lake operated in 1939 and 1940 showed that emergence occurred every day throughout the season during the 2 years of study, except 8 days in 1939 and 6 days in 1940, when storms prevented examination of the cages. The daily emergence was sporadic and irregular and ranged from less than 1 to 75 gnats per square foot. The average seasonal recovery was 487 per foot in 1939 and 654 per foot in 1940. The emergence was greatest within three-fourths of a mile from shore, the two cages in this area taking 57.2 per cent of the total recovery in 1939 and 55.7 per cent in 1940. Samples of bottom mud taken throughout the summer at the cages showed a scanty larval and pupal population near shore and a high population farther out.

The peak activity was in the last half of July in 1939 and in the first part of August, 1940. A fairly gradual increase in emergence occurred before the peaks and a decline thereafter. The overwintering generation continued to emerge over a 67-day period in 1939.

The pest emerged in the spring in good numbers at a water temperature of 62° to 70° F., but during the fall pupation and emergence were greatly reduced at 70° and nearly ceased at 65°. On the basis of the emergence represented by the five cages in 1939 the overwintering generation accounted for at least 163 gnats per square foot and the summer generations totaled 325, or twice the original overwintering population. In 1940 the overwintering generation accounted for an estimated 127 per square foot and the summer generations totaled 535, or an increase of 4¼ times.

An estimate of the total seasonal emergence from the upper, or large, arm of the lake, comprising approximately 44 square miles, on the basis of the recovery cages was approximately 531 billion, or 266 tons, of **Chaoborus astictopus** in 1939. In 1940 the total production was approximately 712 billion gnats, or 356 tons.

The sex-ratio of 27,930 emerged individuals taken from recovery cages on the lake showed 60.2 per cent males and 39.8 per cent females. The emergence occurred during the night between the hours of 11 P. M. and 6 A. M.

LITERATURE CITED

Eggleton, Frank E. 1931. A limnological study of the profundal bottom fauna of certain fresh water lakes. Ecol. Monog. 1: [231] - [332], 62 figs.

Eggleton, Frank E. 1932. Limnetic distribution and migration of corethra larvae in two Michigan lakes. Mich. Acad. Sci., Arts, and Letters Papers 15: 361-388, 6 figs.

Herms, W. B. 1937. The Clear Lake gnat. Calif. Agr. Expt. Sta. Bul. 607, 22 pp., 10 figs.

Miller, R .B 1941. Some observations on **Chaoborus punctipennis** Say (Diptera, Culicidae). Canad. Ent. 73: (37)-39.

Muttkowski, Richard Anthony. 1918. The fauna of Lake Mendota: a qualitative and quantitative survey with special reference to the insects Wisc. Acad. Sci., Arts, Letters, Trans. 19. 375-482.

ACIDIFIED NICOTINE SPRAYS FOR HORN FLIES ON CATTLE

W. G. BRUCE
U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine

Nicotine has been in common usage as an insecticide against certain phytophagous insects for many years. Ordinarily it is used as a nicotine sulfate solution with or without soap, or as nicotine or tobacco dust. Lime is often added to the solutions and dusts to liberate the toxic nicotine more quickly.

The use of nicotine as an insecticide against the external parasites of domestic animals is infrequent mainly because of the danger of nicotine poisoning of the animals.

Nicotine is extremely toxic to the horn fly (**Haematobia irritans** (L.)). The writer has killed quite easily horn flies and stableflies (**Stomoxys calcitrans** L.) with tobacco smoke, fumes from nicotine solutions, and nicotine sprays. This paper, however, is primarily concerned with the toxicity of nicotine sprays as used against horn flies.

Nicotine, as ordinarily used, is rapidly dissipated. The toxicity of a 0.5 per cent aqueous nicotine solution to horn flies on cattle is lost in about 15 minutes at 90 degrees F. The addition of certain acids to nicotine solutions not only prolongs the toxicity of the nicotine but evidently lessens the danger of nicotine absorption by the animal.

Initial tests indicated that when glacial acetic acid was added to solutions of nicotine sulfate, the toxicity of the spray on the cattle was prolonged. The spray had no harmful effect upon the animals, and the solution was stabilized. The glacial acetic acid, however, imparted a sharp odor that was slightly repellent to horn flies and would certainly be objectionable around dairy barns. Subsequent tests with weak aqueous solutions of pure nicotine and certain acids disclosed some interesting results.

Tests with nicotine sprays against horn flies on cattle were started in 1939 and continued, intermittently, in 1940 and 1941.

PROCEDURE

The method used in testing the toxicity of nicotine sprays against horn flies was different from, and is believed to be superior to, those generally used. The testing of fly sprays and fly repellents on cattle is usually carried on in the field, the killing power or repellency of the spray material being ascertained by regular observations of infestations. Cattle thus exposed in nature are subject to infestations of transient flies and to loss of flies by migration. Furthermore, it is extremely difficult, if not impossible, to determine the actual fly mortality. In the present tests with nicotine sprays the test animal was confined in a screened building and infested with a known number of flies. The actual number of flies alive at the time of each observation could therefore be accurately determined. In the initial tests the animal was sprayed in the screened building. Later, to obviate the possible effect of fumigation and spray residue on the sides of the building, the animal was sprayed outdoors and then confined in the screened building, after which a known number of flies were released on the animal. The mortality of the flies was recorded and the effect of the spray material on the animal noted.

In considering these tests it is well to bear in mind two facts: (1). Horn flies remain on the host continuously, and (2) they are quickly knocked down by nicotine but some recover from an initial dose. In this latter case the flies return to the animal and, if the toxicity of the spray persists, the flies will receive a second and possibly a third dose.

Nicotine Sprays

Pure nicotine was used in compounding an aqueous solution containing approximately 0.42 per cent of nicotine. A yearling heifer was confined in a screened building, infested with 100 horn flies, and sprayed with a hand sprayer using 40 ml. of the solution. All the flies were immediately knocked down, but a few subsequently recovered. Ten horn flies were alive 2 hours after the spraying. The addition of formalin (2 per cent) to prevent the growth of bacteria and molds in the solution did not materially alter the toxicity of the spray.

Nicotine Sulfate Sprays

A yearling steer was confined in a screened building, infested with 100 horn flies, and sprayed with approximately 50 ml. of an aqueous solution of commercial nicotine sulfate containing 0.4 per cent of nicotine. All the flies dropped from the animal within a few minutes after the spraying, but some recovered. Twenty-eight flies were still alive after 5 hours.

Nicotine Sulfate and Glacial Acetic Acid

Nine tests were made with aqueous solutions of nicotine sulfate

containing 5 per cent of glacial acetic acid and from 0.12 to 1.00 per cent of nicotine. In one test 30 ml. of a 0.5 per cent solution gave a 100 per cent kill of 100 horn flies released before spraying and only a 30 per cent kill of 100 horn flies released 1 hour after spraying. In another test 30 ml. of a 1.0 per cent solution gave a 100 per cent kill of 100 horn flies released immediately after spraying and a 58 per cent kill of flies released 1 hour later. Again, a 2-year-old heifer was sprayed with 60 ml. of a 1.0 per cent solution and infested with 100 horn flies immediately after spraying, another 100 flies 1 hour after spraying, and a third 100 flies 2 hours after spraying. Only 16 flies were alive 6 hours after spraying. Glacial acetic acid alone had no toxic effect upon horn flies as demonstrated in one test in which a 2-year-old heifer was sprayed with 30 ml. of a 5 per cent solution. The animal was confined in a screened building and infested with 100 horn flies. Six hours after spraying, all the flies were alive.

Nicotine Malate

The aqueous solutions of nicotine malate were compounded from pure nicotine and malic acid, with a moderate excess of malic acid. Only four tests were made with nicotine malate containing 0.5 per cent of nicotine and approximately 1.0 per cent of malic acid killed 98 per cent of the horn flies that were on the animal at the time of spraying.

Nicotine Lactate

The aqueous solutions of nicotine lactate were compounded from pure nicotine and lactic acid, with an excess of the acid. The stock solution of nicotine lactate containing 5 per cent of nicotine and 10 per cent of lactic acid. Ten tests with nicotine lactate solutions gave consistently excellent results. Thirty-five ml. of a nicotine lactate solution containing 0.42 per cent of nicotine killed all 100 flies on the animal at the time of spraying. One animal was sprayed with 340 ml. of nicotine lactate containing 0.5 per cent of nicotine and infested with 100 horn flies immediately after spraying and each hour thereafter for 5 hours. A 100 per cent mortality was recorded for each of the first five infestations and a 50 per cent mortality of the 100 flies released 6 hours after spraying. In another test 150 ml. of nicotine lactate containing 1.0 per cent of nicotine was sprayed on a yearling heifer. Approximately 100 horn flies were released each hour for 7 hours. All the flies were killed except 6 of the 100 released 7 hours after spraying. Nicotine lactate is nonrepellent, but the flies soon succumb after coming in contact with a sprayed animal.

Nicotine lactate sprays had no harmful effect upon the cattle. However, one steer exhibited a little uneasiness 2 hours after 500

ml. of nicotine lactate containing 0.5 per cent of nicotine had been briskly applied with a brush.

Aqueous solutions of nicotine and of nicotine sulfate were unstable and in a few days become cloudy and "stringy." This condition was evidently due to the growth of bacteria and molds since one or both these growths were found in the solutions as shown in the following table:

Hydrogen-Ion Concentration and Bacteriological Tests of Nicotine Solutions[1]

Material	Nicotine, per cent	pH[2]	Bacteria	Molds
Nicotine	5.0	8.4+ +	— ?	+ +
Nicotine plus 2% formalin	5.0	8.4+ +	—	—
Nicotine sulfate plus 5% glacial acetic acid	0.6	4.8— —	—	—
Nicotine lactate	0.5	4.8—	+	+ +
Nicotine lactate plus 2% formalin	5.0	4.8—	—	—
Nicotine lactate plus 0.5% sodium benzoate	0.5	4.8—	+ + +	—
Nicotine malate	5.0	4.8—	+ +	+ ?
Nicotine malate plus 2% formalin	5.0	4.8—	—	—
Nicotine sulfate	4.0		+ +	
Nicotine sulfate plus 5% glacial acetic acid	0.3		—	

[1]Colorimetric pH tests (limited between 4.8 and 8.4) and agar slant and agar plate tests for bacteria and molds made by Dr. E. W. Laake.

[2]+ + well above 8.4, — slightly below 4.8, — — well below 4.8.

The addition of glacial acetic acid or formalin to the solutions inhibited the development of bacteria and molds and the solutions remained clear for over 1 year.

SUMMARY

Experiments were conducted to determine the toxicity of nicotine sprays against horn flies on cattle. When certain acids were incorporated in the nicotine sprays the toxicity was prolonged and the spray was considerably more effective against horn flies than when no acids were added. Nicotine lactate, an aqueous solution of nicotine containing 0.5 per cent of nicotine and 1.0 per cent of lactic acid, and the combination of nicotine sulfate and acetic acid, were effective, but the latter was objectionable because of its disagreeable odor.

ADDITIONS TO THE "ROBBER FLIES OF COLORADO."

MAURICE T. JAMES, Colorado State College

In the present supplement to my "Robber Flies of Colorado,*" only data which will materially extend either the geographical or altitudinal range or our knowledge of the taxonomy of the species are included. Three species (numbers 148 to 150) are added to the Colorado list, one of them being new to science.

3. **Leptogaster coloradensis** James. Falfa, 7000 ft., May 31, 1940 (Rotger).

8. **Comantella fallei** (Back). Las Animas, Nov. 15, 1940 (T. R. Robb).

17. **Lestomyia strigipes** Curran. Arboles, May 12, 1939 (Rotger); Allison, June 10, 1940 (Rotger).

20. **Buckellia brevicornis** (Williston). Evergreen, Aug. 6 & 8. 1941 (James). Fairly common on fallen logs of **Pinus ponderosa.**

46. **Lasiopogon oklahomensis** Cole & Wilcox. Snow Ball R., Mineral Co., 9000 ft., June 20, 1940 (B. Rotger).

48. **Lasiopogon aldrichii** Melander. Science Lodge, near Ward, June 20 & Aug. 15, 1940 (U. N. Lanham).

50. **Coleomyia alticola** James. Phillipsburg, Aug. 5, 1941 (James); Evergreen, Aug. 8, 1941 (James); Gould, near Cameron Pass, Aug. 19-21, 1941 (James). The number of hypopleural bristles seems to vary from one to three or four.

54. **Cyrtopogon pulcher** Lw. Evergreen, July 13, 1941 (James); Phillipsburg, Aug. 5, 1941 (James). The third antennal segment varies from wholly red to wholly black.

56. **Cyrtopogon dasyllis** Will. Science Lodge, near Ward, Aug. 15, 1941 (Lanham).

62. **Cyrtopogon montanus wilcoxi,** n. ssp.

Cyrtopogon montanus James, 1941, Jour. Kans. Ent. Soc., 14:41.

More Eastern in distribution than typical **montanus,** and the form which I have taken for **leucozona** Lw. The abdominal pollinose bands on segments two to four of both sexes and on five of the female are entire, the abdomen is less glossy, the abdominal pile in the female and the lateral pile on approximately the white-pollinose area of the male is white, the entire insect is accordingly paler in color than the typical form. The front tarsi are characteristically reddish, and the mystax as a rule more extensively black.

Holotype, male, **allotype,** female, and **paratopotypes,** 5 males, 2 females, A.S.U.C. Lodge, Boulder, Colo., June 15, 1933. **Paratypes:**

*Jour. Kans. Ent. Soc., 14: 27-53. 1941.

1 female, Raymonds, Colo., July 10, 1937 (James); 1 male, 1 female, Boulder, Colo., June 26, 1933 (M. & H. James); 2 males, Boulder, Colo., June 27, 193? (James); 1 male, 1 female near Ward, Colo., June 2-9, 1933 (H. G. & H. E. Rodeck); 1 male, 2 females, Boulder, Colo., June 22, 1935 (E. I. & R. H. Beamer); 1 male, Hinsdale Co., Colo., June 28, 1937 (R. H. Beamer); 1 female, Edwards, Colo., June 25, 1932 (L. G. Davis); 1 female, Larimer Co. foothills, Colo., June 26, 1915 (M. A. Palmer); 2 females, Longs Peak, Colo., July 10, 1917 (M. Lings); 1 male, Gold Hill, Colo., June 24, 1932 (James); 1 female, Lonetree, Colo., May 11, 1934 (B. Rotger); 7 females, 2 males, Evergreen, Colo., June 28-30, July 1, 1941 (James); 1 male, 1 female, Boulder, Colo., May 14, 1939 (R. Bauer); 1 male, 15 miles north of Meeker, Colo., June 15, 1939 (U. Lanham); 1 male, Grand Mesa, Colo., July 7, 1938 (Lanham); 1 male, Glacier Lake, Boulder Co., Colo., June 28, 1937 (Helen Rodeck); 1 female, Muskee Lake, nr. Nederland, Colo., June 23, 1936 (Helen Rodeck); 1 female, 8 miles east of Ward, Colo., June 24, 1939 (Lanham); 1 female, Peaceful Valley and Allens Park, Colo., July 6 (Cockerell); 1 female, 7 miles south of Glade Park, Colo., June 21, 1938 (Lanham); 1 female, Moraine Park, Rocky Mountain National Park, June 29, 1933 (Helen Rodeck).

Named in honor of Dr. Joseph Wilcox, to whom I am indebted for suggestions and for the loan of specimens.

Specimens from western Montana, Idaho, and eastern Washington and Oregon may be typical **leucozona**. These have darker legs, the front tarsi being black. As in the Colorado series in both sexes, the abdominal pollinose bands and the pile of the abdomen are as described for **wilcoxi**. A few Colorado specimens, not designated as types, vary in one respect or another from the above description, but in general they conform.

72. **Holopogon guttula** Wd. Evergreen, July 18, 1941 (James).

79. **Asilus nitidifacies** Hine. Science Lodge, near Ward. Aug. 2, 1940 (Lanham).

83. **Asilus vescus** Hine. Evergreen, Aug. 6 & 8, 1941 (James), on fallen trunks of **Pinus ponderosa.**

86. **Asilus formosus** Hine. Ft. Collins, July 13, 1939 (James), entrance of prairie dog hole; Juanita, 6400 ft., July 3, 1938 (Rotger); Arboles, 6000 ft., July 4, 1938 (Rotger).

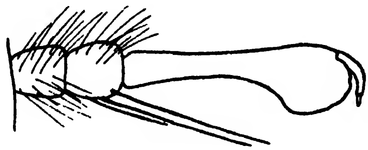
146. **Laphria aimatis** McAtee. Estes Park, June 24, 1939, and July 25, 1939 (Wayne Howe).

147. **Laphria felis varipes** McAtee. Snowball Ranch, Mineral Co., 9000 ft., June 20, 1940 (Rotger).

148. **Laphystia varipes** Curran. Ordway, Colo., July 4, 1941

(Fred Kropf).

149. **Nannocyrtopogon aristatus, n. sp. Male.** Head black, with dense white pollen which covers practically all the head except a large shining area on the upper half of the face; mystax, pile and bristles of vertex, front, face, antennae, and palpi, and supra-occipital bristles black; beard and hairs of lower occiput white and silky. Ratio of three antennal segments and style 6:6:23:6; third segment much enlarged at apex; style inserted on dorsal surface near apex, and resembling a short, thick arista. Thorax wholly black; pollen of middle of dorsum, except for two rows along dorsocentrals, brownish, that of thorax and scutellum otherwise white; bristles and hairs of dorsum marginal scutellars (two to four in number) and upper hypopleurals black; lower hypopleurals and pile of pleura white. Legs black; bristles and coarser hair white, fine hair mostly white, yellowish on inner surface of hind tibiae and tarsi. Wings hyaline. Halteres brown, knobs somewhat darker. Abdomen shining black, with bluish reflections; moderately long white pile laterally on first and second segments; pile otherwise short, black, most conspicuous on genitalia; pile of venter, except genital segments, scant, fine, white. Dorsum with narrow white-pollinose bands basally on segments two to five, inconspicuous on five, most prominent on three and four; sides of one and lateral posterior spots on two to six white-pollinose; venter white-pollinose except middle of segments. Length, 6-7 mm.



Nannocyrtopogon aristatus

Female. Face entirely pollinose. Pollinose band on segment five more conspicuous. Genital spines yellow. Otherwise as in male.

Holotype, male **allotype,** female, and **paratypes,** 3 males, 4 females, Arboles, Colo., 6700 ft., May 17, 1939 (B. Rotger, C. R.), Colorado State College and Rotger collections.

The form of the antenna will distinguish this species from any other known member of the genus. The genus traces to **Cyrtopogon** in my key, but may be distinguished from that genus by the fact that the scutellum is bare on the disc and has strong marginal bristles.

150. **Erax pilosus** Hine. Towac, Montezuma Co., May 1939 (Rotger).

STUDIES IN NEW WORLD PHILIA (BIBIONIDAE)

PART I

D. ELMO HARDY, Lawrence, Kansas

The material discussed in this paper has been received from the U. S. National Museum, The American Museum, Cambridge Museum of Natural History, Dr. H. de Sousa Lopes, Rio de Janeiro, and Mr. P. C. Ting, San Francisco, California.

Philia anomala n. sp.
(figs 1a-b)

This species is somewhat related to **P. dorsalis** (Phil.) by having three sets of teeth on the front tibiae and the front coxae and femora rufous. It is distinguished by the chiefly black thorax and slender hind tibia of male and the different arrangement and number of teeth on the front tibiae in both sexes. **P. dorsalis** has five strong dorsal spines on front tibiae, two near the base and three located just beyond the middle.

Male.—Medium sized, chiefly blackish species, rather thickly covered with brown to black pile. **Head:** Compound eyes divided, upper portion brown pilose. Ocellar tubercle covered with short yellowish pile above. Rostrum produced about as long as the lower portion of the compound eyes; under portion of head with abundant long black hairs. Antennae broken in type, scape and pedicel black with a faint yellowish tinge. **Thorax:** Black, with a tinge of yellowish red in the ground color. Dorsocentral hairs strong. Halteres black. Thoracic combs rather weak, anterior comb divided medianly and composed of twelve short teeth. **Legs:** Front coxae, trochanters and femora rufous, middle femora and bases of posterior pair dark rufous tinged, legs otherwise black. Front tibiae with three sets of teeth, three to four teeth in top set, four teeth in median set and eight in the apical set besides the short apical spur. The left anterior tibia of this specimen has four teeth in top set while the right tibia has just three (figs. 1a-1b). Segments of hind legs slender, tibiae scarcely enlarged at apices, sides almost straight. **Wings:** Brownish fumose, costal margin and stigmata blackish. Abdomen black, with a faint brown tinge to the terga. **Genitalia:** Coxopodite cleft about one-third its length. Harpagones well developed, greatly thickened at bases and narrowing apically. Hind margin of ninth tergum straight or nearly so. Cerci bright yellow, conspicuous.

Length: body and wings, 5.5 mm.

Female.—Thorax entirely rufous except for brownish red pleurae. Thoracic combs more pronounced, anterior comb more distinctly divided, teeth longer. Rostrum produced longer than the eyes. An-

tennae twelve segmented. counting nipple-like tip. Middle femora and bases of posterior pair more rufous. Front tibiae with three teeth in the top set and five in the median set. Entire genitalia yellowish red, cerci bright colored and conspicuous.

Length: body and wings, 5.7 mm.

This species represents another example of sexual dimorphism in the number and arrangement of the teeth on front tibiae.

Holotype male, San Rafael, V. C. Mexico, 3-3 (Townsend). Allotype female, same data. Both returned to U. S. National Museum.

Philia globosa n. sp.

(Figs. 2a-d)

This species is related to **P. rhynchops** (Coq.) but is readily distinguished by its smaller size, the swollen subsegments of the posterior tarsi, yellow femora, and the arrangement of the spines of front tibiae.

Male.—Small, chiefly black or brownish species. **Head:** Compound eyes divided transversely at about the lower one-third. Ocellar tubercle pronounced, densely covered with fine, brownish pile on upper portion. Antennae black, composed of eight to nine closely compacted segments. Rostrum brownish, produced longer than the antennae and almost as long as the head. **Thorax:** Dorsum polished black, chiefly bare except for long, brown dorsocentral and marginal hairs, hind portion of mesonotum sometimes faintly browned. Pleurae brownish with a tinge of yellow. Stems of halteres pale, knobs black. Thoracic combs not divided, front comb composed of twelve rather bluntly pointed teeth. **Legs:** Coxae brownish, trochanters, femora and most of tibiae yellow, posterior tibiae brownish black at apices; teeth of front tibiae reddish. Tarsi brown to black. Front tibiae each with three series of teeth on dorsal surface (fig. 2c); the top set possesses two teeth and is at basal one-third of tibia; the second set has four teeth and is just below the middle; the apical set has seven teeth besides the short black tibial spur. Pile of legs yellow to yellow-brown. Posterior femora slender, posterior tibiae clavate, thicker at apices than greatest width of femora. Tarsal subsegments strongly swollen (fig. 2d), metatarsi thicker than apices of tibiae, especially from dorsal view. Empodia and pulvilli yellow, conspicuously fringed on their margins. **Wings:** Very lightly yellow-brown fumose; stigma brown, darker than the membrane; veins yellow-brown. Abdomen shining black clothed with sparse elongate black hairs. **Genitalia:** Coxopodite with a very shallow cleft on posterior margin, extending less than a fourth the length of the segment. The median portion of the cleft possesses a well developed mound-like protrubrance which extends as long as the posterior lateral lobes. Harpagones simple, rather bluntly tipped (fig. 2a).

Ninth tergum about two times as wide as long, posterior margin straight (fig. 2b) without any noticeable concavity. Cerci large, rounded and thickly haired.

Length: Body, 3.3-3.5 mm.; wings, 3.2-3.4 mm.

Female.—The female differs in being almost entirely reddish-yellow with only the head and last few tarsal subsegments black; the abdominal sclerites and knobs of halteres are brownish. The scape and pedicel of antennae are yellowish; the rostrum is produced longer than head; the posterior tibiae only slightly clavate and the tarsal subsegments slender.

Holotype male, allotype female and one paratype male: Cantareira, Sao Paulo, Brazil, 8-9-34 (S. Lopes et L Trav. F.)

All in Snow Entomological Collection.

Philia minima n. sp.
(figs. 3a-b)

Related to **P. plaumanni** (Edwards) but readily distinguished by its small size, different number and arrangement of teeth on front tibiae, entirely rufous thorax and legs and the hyaline wings and colorless stigmata.

Male.—Very small species. **Head:** Compound eyes divided by a transverse depression near the lower one-third, very sparsely yellowish pilose. Ocellar tubercle prominent, with fine yellow pile on upper portion. Antennae eight segmented, basal segments yellow. Rostrum short, scarcely produced over half the length of antennae. **Thorax:** Entirely yellow except for slight discolorations of brownish-yellow on the pleurae. Thoracic combs slightly divided medianly, the front comb composed of ten, rather slender sharply pointed teeth. Dorsocentral hairs strong. Stems of halteres pale, knobs brown. **Legs:** Chiefly yellow, with yellow-brown pile; last three subsegments of tarsi blackish, tibiae teeth and tarsal spurs red. Front tibiae with three sets of teeth on dorsal surface. The top set has two teeth and is situated at basal one-third of tibiae, the middle set has four teeth and is located near the apical two-thirds of tibiae, the apical set has eight teeth besides the short tibial spur. These teeth are arranged as in **Philia globosa** n. sp. (fig. 2c), they are more slender and sharply pointed, however, than in that species. All leg joints slender, posterior tibiae or tarsi not at all swollen. **Wings:** Hyaline, veins only faintly yellowish, stigmata concolorous with the membrane. Abdomen brownish black, sparsely brown haired. **Genitalia:** Cleft of coxopodite extending about one-third the length of segment. The mound-like development in the median portion of the cleft not extending as far as posterior lateral margins of sternum. Harpagones simple, curved inward (fig. 3a). Ninth tergum nearly three times as wide as long, posterior margin very gently concave

(fig. 3b).

Length: body, 2.2-2.6 mm.; wings, 2.4-2.7 mm.

Female unknown.

This species and **P. microcerus** (Edwards) are the smallest **Philia** known to the writer.

Holotype male and nine paratype males; Higuito, San Mateo, Costa Rica (Pablo Schild).

Holotype and five paratypes returned to U. S. National Museum, others retained in Snow Entomological Collection.

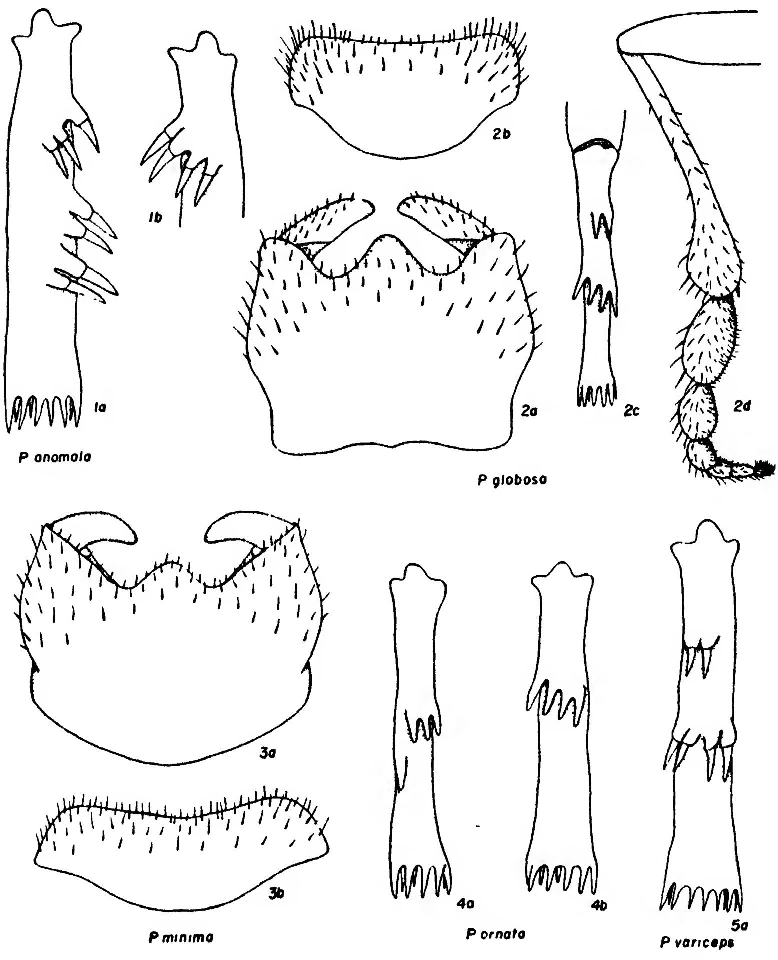
Philia ornata n. sp.

This species is more nearly related to **P. luteus** (Edwards). The males are distinguished by the different arrangement of the teeth on anterior tibiae: three teeth in top set and just a single tooth between this and the apical set, instead of having two teeth in each of the dorsal sets; chiefly black legs and concolorous stigmata and by the radius, radio-medial crossvein and stem of medius bare instead of with stout hairs. The females are separated by the black pleurae, tibiae and posterior femora and brown posterior veins.

Male.—Medium sized, chiefly black species. Head: Compound eyes sparsely covered with short brown pile. Ocellar triangle shining black, entirely bare on dorsal portion. Compound eyes divided on about lower third. Rostrum slightly produced but short, scarcely over half the antennal length. Antennae broken in type male, probably nine segmented, scape and pedicel blackish-brown. Under portion of head and rostrum with scattered long white hairs. **Thorax:** Entirely polished black, except for faint brownish tinge on pleurae; with sparse yellowish hairs on dorsum. Thoracic combs not divided medianly, the anterior comb composed of twelve rather small teeth. Knobs of halteres black, stems slightly yellowed. **Legs:** Coxae and middle and anterior pairs of femora brownish, legs otherwise black. Pile of coxae and femora yellowish, of tibiae and tarsi brown. Anterior tibiae each with a set of three teeth in a transverse row at about the middle and a single tooth at about apical two-thirds of tibiae (fig. 4a). Apical set with seven teeth besides the spur, tibial spur equal in size to the teeth. **Wings:** Hyaline, stigmata concolorous with the membrane. Anterior veins yellow, posterior very pale. Abdomen polished black except for brownish tinge on first four terga. Sparsely yellow pilose.

Length: body, 6.0 mm.; wings, 3.33 mm.

Female.—The dorsum of thorax, front and middle coxae, trochanters and femora yellow. Pleurae black, with a brownish-yellow tinge. Antennae eleven segmented, including the button-like tip, scape and pedicel yellow. Rostrum marked with yellow above and below, slightly longer than in male but much shorter than the eye



EXPLANATION OF PLATE

Fig. 1. **Philia anomala** n. sp., a. Right anterior tibia, male b. Left anterior tibia, upper portion, male.

Fig. 2. **P. globosa** n. sp., a. Male genitalia, ventral. b. ninth tergum of male, dorsal. c. anterior tibia of male, dorsal. d. posterior tibia and tarsus of male, lateral.

Fig. 3. **P. minima** n. sp., a. male genitalia, ventral. b ninth tergum of male, dorsal.

Fig. 4. **P. ornata** n. sp., a. Right anterior tibia of male. b. left anterior tibia of female.

Fig. 5. **P. variceps** n. sp., a. Right anterior tibia of male.

length. Posterior tibiae with just one set of four spines above the apical set, these are arranged in slightly oblique row (fig. 4b). Wings faintly yellowish, stigmata and anterior veins brown, posteriors yellow-brown.

Length: body and wings, 6.2 mm.

This species represents one of the few known examples of sexual dimorphism in the arrangement of the teeth on the front tibiae.

Holotype male and allotype female on same pin, Gaut. City, Guatemala, El. 5000 ft., March, 1932 (C. N. Ainslie). Six paratype females: four from San Pedro de Montes de Oca, Costa Rica, 1-22-1936 (C. H. Ballou); one, San Isidro, C. R. (G. F. Tristan) and one Tegucigalpa, Honduras, II-19-18 (F. J. Dyer).

Holotype, allotype and three paratypes returned to United States National Museum, three retained in Snow Entomological Collection.

Philia tingi n. sp.*

This species is related to **P. spinipes** (Say) by having three series of teeth-like spines on each of the front tibiae, it is readily distinguished by the short costa, the black coloration, the blunt, rounding teeth of thoracic combs, its much smaller size and the shorter head length of the females.

Female.—Head: Entirely shining black, rather thickly black haired. The rostrum is produced longer than the antennae and the extended mouthparts reach almost three times the antennal length. Antennae short, the segments compacted, apparently eleven segmented, the segments of the flagellum are so compressed that it is difficult to discern their articulations. The rostrum is shorter than the antennae in **spinipes** and the mouthparts are not so elongated. The compound eyes are longer than the length of head behind the eyes, eyes of **spinipes** much shorter, more rounding. **Thorax**: Shining black, except the faintly reddish thoracic combs. Teeth of thoracic combs short and blunt, anterior comb composed of ten to twelve teeth, comb scarcely divided in the middle. Dorsocentral and marginal hairs long and thin, mesopleurae and sternopleurae with scattered long marginal pile; all thoracic pile yellowish. **Legs**: Largely black, only the front tibiae rufous; front femora and coxae faintly reddish tinged in the median portions; all tibiae and metatarsi with a very faint rufous cast in the black ground color. Front tibiae with three series of spines, the top set is situated on the upper third of the segment and contains just two teeth; the middle set is at about the median portion and has three teeth; the third or apical set is made up of eight spines counting the apical spur. All tibial spines are rather broad and blunt, the apical spur is shining black and much

*This species is figured in the forthcoming revision of the Nearctic Bibionidae.

larger than the spines at the ends of the tibiae. **Philia spinipes** has three teeth in the top set and four in the median, the spines are more acute and the apical set contains eleven or twelve teeth. **Wings:** Entirely hyaline, anterior veins and stigma brown, posteriors concolorous with the membrane. The costa extends but a short distance beyond the tip of vein R_5 (posterior branch of radius), about one-fifth the distance between tips of R_5 and M_1; the costa of **spinipes** extends half the distance between these veins. The abdomen is blackish-brown, the sclerites and conjunctiva of the venter are faintly tinged with yellowish. Cerci black, covered with thick yellow pile.

Length: body and wings, 3.4-3.5 mm.

Male.—Compound eyes sparsely brown to black haired, lower one-third to one-fourth of each eye is divided off by a transverse depressed area. Rostrum longer than antennae and covered with dense black hair and mouthparts produced as in female. Body and legs entirely black.

Length: Body and wings, 3-3.1 mm.

Holotype female, Cronise Lk., San B. Co., Cal., April 28, 1937, No. 300 (P. C. Ting). Allotype male and two paratype females, same data as type. These specimens were collected on blossoms of Prosopis.

The writer takes pleasure in naming this species after Mr. P. C. Ting, State of California, Department of Agriculture, who has contributed much valuable information concerning the immature stages of the Bibionidae.

Holotype, allotype and one paratype in Snow Entomological Collection, by permission of Mr. Ting, and one paratype deposited in U. S. National Museum.

Philia variceps n. sp.

(fig. 5a)

This species is related to **P. castanipes** (Bigot) but is distinguished by its much smaller size; the vertical brown stripe occupying most of the mesopleurae and sternopleurae; the yellow scutellum and chiefly yellowish legs; the difference in number and arrangement of spines on front tibiae and shorter apical spurs.

Female.—Head: Shining black, with sparse dark hairs. Rostrum produced about three fourths the length of the compound eyes, portion of head behind the eye slightly longer than the rostrum. Antennae eleven segmented, chiefly yellowish, only the apical four to six segments brown. Labella yellow-brown, palpi brown. **Thorax:** Entirely yellowish except for brown mesopleurae and sternopleurae, black anterior comb and brownish area between the thoracic combs.

Combs not especially prominent, anterior comb divided medianly, composed of twelve to fourteen rather sharp teeth. Stems of halteres pale, knob brown. **Legs**: Coxae, trochanters, most of tibiae and metatarsi bright yellow, apices of tibiae, metatarsi and remaining tarsal subsegments black. Pile yellow-brown to black. Front tibiae with three sets of spines on dorsal surface, the top set is located at basal one-third and composed of two spines, rarely three; the median set is near the apical two-thirds of tibiae and made up of four spines (fig. 5a); apical set composed of nine spines, apical spur about equal in size to the spines. All leg joints slender. **Wings**: Brownish-yellow fumose darker on anterior margin. Stigmata and veins brown. Abdomen brownish-black, genitalia yellowish.

Length: body and wings, 4-4.66 mm.

Male unknown.

Holotye female: Tabernilla Canal Zone, Panama, May, 1907 (August Busck). Six paratypes: one, same data as type; one Trinidad Rio Panama, III-26-12 (A. Busck) and four Barro Colo. Isld., Canal Zone, XI-22 to I-9-1929 (M. Bates, Griswold and C. H. Curran).

One female specimen from Chimbotes Amaz. Peru., Mar. 20, 31 (R. C. Shannon) apparently belongs to this species.

Holotype, one paratype and the Peruvian specimen are being returned to the United States National Museum, one returned to the American Museum, two to Cabridge Museum of Comparative Zoology and two retained in Snow Entomological Collection.

AN OBSERVATION ON PROMACHUS, A LARGE ROBBERFLY

RAYMOND ROBERTS, University of Nebraska

After reading a note by G. F. Knowlton and G. S. Strain of the Utah Agricultural Experiment Station, in the Bulletin of the Brooklyn Entomological Society, Vol. 37, p. 42, just received, I am forced to write of a personal experience with a large robberfly of the genus **Promachus**. I have felt for several years that I should report this observation but there are a couple of things which make it indefinite. In the first place, while I captured the fly, I did not at the time attribute sufficient importance to the incident as to identify the species, and by the time that I considered writing it up several years had elapsed.

The fall of 1926 I was walking along a drive at the end of a cornfield where large robberflies sat on the ends of dried weed stalks waiting for grasshoppers to hop up or take flight. In some cases grasshopper nymphs were captured while in the air. I never saw a robberfly attempt to capture an insect on the ground. With almost unerring accuracy, however, one of these large flies would take off, the loud hum of its wings indicating the speed of its flight, and it would catch a grasshopper in mid-air. On one such occassion a fly caught a grasshopper so close to me, and alighted upon a twig so close, that I was tempted to reach out and catch the fly and its prey with a sweep of the hand. My cyanide bottle, of course, was in my right hip pocket, and I had to reach around and get it with my left hand and remove a screw cap. This procedure was rather clumsy and required some time.

The robberfly was hesitant, at first, to release its hold upon the grasshopper, but when it set up a warning buzz and did not gain its release, it let go of the grasshopper and inserted the beak into my index finger between the first and second joints. I am amazed at the complacency with which the authors referred to above state, "The 'bites' were temporarily painful." My finger swelled up until it was impossible to flex it but slightly when closing my hand. On the second day there were severe shooting pains running up my arm and I had a large glandular lump under my arm. The discomfort continued to some extent for a week.

It is said that only a relatively few rattlesnakes have enough venom in the poison sacs to cause a fatal bite to a full-grown person at any particular time. This robber fly had just injected sufficient poison into the body of the grasshopper to kill it, for I saved the fly and the grasshopper and I observed the hopper for almost two weeks. Although it was moving slightly when I captured the fly with it, the grasshopper never recovered. The entire procedure from the time that the grasshopper was captured was only a matter of seconds. The salivary or poison injection of the fly must be a violent poison for these flies capture many insects every day. This bite was more than a mechanical puncture as would be indicated by the report of Knowlton and Strain. It involved the injection of a paralyzing fluid.

I assume that Knowlton and Strain mean by "transporting grasshoppers," the activity of the flies in carrying large grasshoppers from the point of capture to a suitable feeding place, atop some twig, as I have indicated. The Diptera do not make provision for their larvae which would eliminate purposeful transportation or storage of grasshoppers.

A NEW GENUS IN THE HALOBATINAE (GERRIDAE-HEMIPTERA)

EUGENE E. KENAGA, Lawrence, Kansas*

In 1935, Drake and Harris described **Halobatopsis parvulus.** This species does not conform with the generic concept of **Halobatopsis** and is not congeneric with **Halobatopsis platensis** Berg. I therefore propose a new genus for **Halobatopsis parvulus** D & H and describe three new species to add to this new genus.

Ovatametra new genus

Eyes shorter than head, width about two-thirds interocular space. Antennae over half length of body. First segment usually longest or subequal to fourth; second segment shortest or subequal to third; fourth segment longer than third. Rostrum extending beyond anterior coxae but not beyound anterior third of mesosternum. Pronotum shorter and narrower than head, anterior margin straight, posterior margin straight in male, much rounded in female, lateral margins rounded. Mesonotum distinctly separated from metanotum, moderately convex, much widened posteriorly, posterior margin moderately curved anteriorly. Metanotum indistinctly divided into two parts; metanotum plus first abdominal segment appearing as a continuous plate, longer than mesonotum.

Anterior femur as long or longer than medial length of mesonotum, tibia at least three-fourths length of femur, tarsus about half lengh of tibia, second segment four times length of first. Intermediate femur much over half length of tibia; tibia not as long as body; tarsus subequal to or longer than femur, first segment longer than second. Posterior femur less than twice length of anterior femur, less than twice posterior tibia; tibia shorter than medial length of pronotum and mesonotum combined; tarsus about two-thirds length of tibia, first segment shorter than second.

Ovatametra is most closely related to Halobatopsis and Trepobates.

Ovatametra differs from Halobatopsis by:

1. Intermediate tibia not as long as body.
2. Posterior femur not twice length of anterior femur.
3. Metanotum plus first abdominal segment subequal to or longer than mesonotum.
4. Intermediate tarsus subequal to or longer than intermediate femur.
5. Posterior tibia shorter than medial length of pronotum and mesonotum.

*Contribution from the Department of Entomology, University of Kansas

Ovatametra differs from Trepobates by:

1. Metanotum plus first abdominal segment subequal to or longer than mesonotum.
2. First antennal segment slightly longer or subequal to fourth, third antennal segment slightly longer or subequal to second.
3. Body length only twice body width.
4. Posterior margin of female pronotum convexly rounded

Ovatametra parvula (D. & H.)

Halobatopsis parvulus, Arkiv för zoologi, Uppsala, Band 28 B, no. 2., p. 3 -1935.

"Small, ovoid; black with yellowish-brown markings. Head with a broad median stripe and a narrow one on each side near the eye black, these all connected behind. Eyes large, brownish, with darkened areas, the distance between them about one and a half times the diameter of each eye. Antennae brownish, the apical portion of basal two segments and all of apical segments darker. Segment I longest, II shortest, IV a little longer than III and slightly shorter than I. Rostrum stout, extending upon the mesosternum, the basal segment yellowish brown, the rest darker.

"Pronotum short, rounded behind, the posterior margin and an elongate spot on each side of median line yellowish-brown. Mesonotum subtruncate behind, black, a large spot and two stripes on each side yellowish-brown. Legs dark, long. Abdomen beneath yellowish-brown.

"Length, 2.28 mm.; width, 1.14 mm.

"Holotype, apterous female, Manaos, Amazon; Roman; Stockholm Museum.

"This species may be recognized at a glance from **H. platensis** (Berg) by its much smaller size, shorter legs, and the proportion of the antennal segments. In some respects the structure of the thorax is somewhat intermediate between that of **H. platensis** and various species of **Trepobates** Uhl. The form of the body, however, seems to leave little doubt as to it being a member of the genus **Halabatopsis** Bianchi."

Notes. **O. parvula** differs from the genera Halobatopsis and Trepobates by the characters given in the generic description. **O. parvula** differs from **O. minima** in lighter color pattern and from **O. obesa** and **O. fusca** in smaller size.

Ovatametra minima n. sp.

Apterous form

Size. Male 2.0-2.22 mm. long, 0.7-1.0 mm. wide; female 2.0-2.2 mm. long, 1.0-1.1 mm. wide.

Color. Body yellowish-tan except mesonotum with black marking. Antennae with basal half of first and second segments light yellow, the rest brown. Head with dark mark in center of head usually surrounded by alternating variable bands, light first, dark again and light on posterior margin and margin of eyes. Apical half of rostrum dark. Pronotum with margin between eyes dark, with dark spots back of eyes and medially, extending to or nearly to posterior margin. Mesothorax with three dark longitudinal bands on side extending from anterior to posterior margins, except most dorsal pair which may be interrupted. Mesonotum chestnut brown, anterior margin dark, medial dark triangular mark of variable size on posterior half, sometimes running forward to coalesce with anterior margin. Orange markings on metanotum and abdomen variable, usually on posterior margins of segments. Legs brown except inside of anterior femora light yellow. Venter light yellow, except males with dark lateral markings on abdomen. Genital segments brown.

Structural characteristics. Antennal formula 1st: 2nd: 3rd: 4th: : 39: 25: 25: 39 in male; 40: 28: 28: 40 in female. Interocular space one and one-half times eye width. Anterior femur slightly longer than mesonotum; tibia three-fourths length of femur with dark recurved spine-like hairs on under side in male; tarsus less than one-half length of tibia, first segment one-fourth length of second. Intermediate femur about seven-tenths length of tibia, tibia as long as medial length from anterior margin of pronotum to apex of abdomen; tarsus slightly longer than femur, first segment slightly longer than second. Hind femur less than twice length of tibia; tarsus two-thirds length of tibia, first segment subequal to second. Pronotum: mesonotum: metanotum plus first abdominal segment : : 22: 49: 51 in male; 20: 57: 63 in female. First ventral abdominal segment subequal to preceding two in female, shorter in male.

Holotype male, allotype, and twenty-five paratypes, Porto Velho, R. Madeira, Brazil, S. A., 9-37, A. M. Olalla. All types in Francis Huntington Snow Entomological Museum, University of Kansas, Lawrence, Kansas.

Notes. **O. minima** differs from other species of this genus by darker dorsal color on mesonotum; absence of dark markings on abdomen; and by smaller size.

Ovatametra obesa sp. n.

Apterous form

Size. Female 2.9-3.1 mm. long, 1.6 mm. wide.

Color. Body dark yellow with black markings. Antennal segments with apical ends dark, last segment all dark. Head with

variable markings, black with longitudinal yellow stripes. Apical two-thirds of rostrum dark. Pronotum with anterior margin black, pair of black spots running back of eyes nearly to posterior margin, median dark band extending nearly to posterior margin. Mesothorax with three black longitudinal bands on each side extending from anterior to posterior margin. Mesonotum with pair of large oval yellow spots on each side of median dark line, surrounded on all sides by black. Metanotum and abdominal segments dark, posterior margin yellow. Legs variable with yellow and dark indistinct markings. Venter light yellow with black on median portion of abdomen and posterior portion of mesosternum. Genital segments dark yellow.

Structural Characteristics. Antennal formula 1st: 2nd: 3rd: 4th: : 52: 36: 37: 52 in female. Interocular space one and a half times eye width. Anterior femur subequal to median length of mesonotum; tibia five-sixths length of femur; tarsus at least half length of tibia, first segment one-fourth length of second. Intermediate femur about three-fifths length of tibia; tibia slightly shorter than medial distance from anterior margin of pronotum to apex of abdomen; tarsus slightly longer than femur, first segment one and a half times length of second. Posterior femur nearly twice length of tibia; tarsus two-thirds length of tibia, first segment shorter than second. Pronotum: mesonotum: metanotum plus first abdominal segment : : 6: 18: 20. Abdomen shorter than metanotum, last dorsal segment with a distinct tuft of dark hairs on median posterior margin. Last ventral abdominal segment equal in length to preceding three segments.

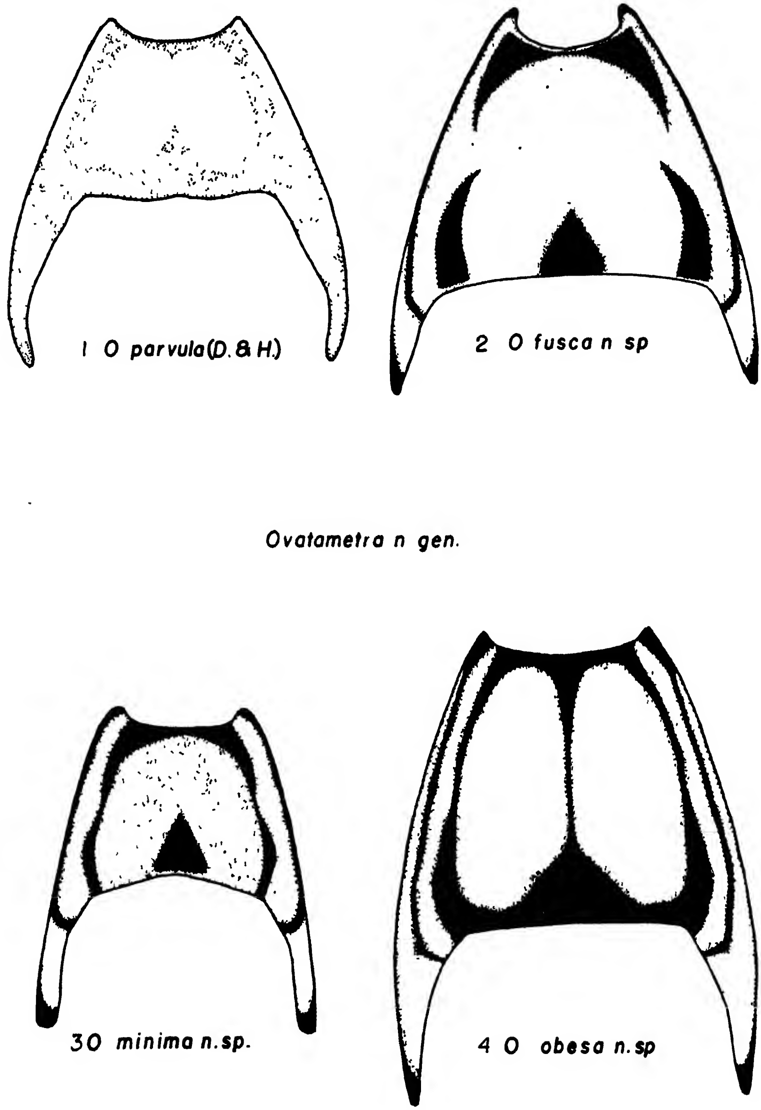
Holotype female, and two paratypes, R. Amazonas (Nrte.), Region de Itacoatiara, Brazil, S. A., Jan.-Apr., 1936. A. M. Olalla. All types in Francis Huntington Snow Entomological Museum, University of Kansas, Lawrence, Kansas.

Notes. O. obesa differs from other species of **Ovatametra** by tuft of hair on posterior margin of last dorsal abdominal segment; by continuous dark median mark from anterior to posterior margin on mesonotum; and by larger size.

Ovatametra fusca n. sp.
Apterous form

Size. Female 2.6 -2.8 mm. long, 1.4 -1.6 mm. wide.

Color Body yellow with dark markings. Antennal segments mostly light with dark markings near apical ends. Head with variable markings, median and lateral dark marks sometimes connecting. Pronotum with pair of dark spots back of eyes running nearly to posterior margin, small median stripe sometimes present. Mesothorax with three dark longitudinal bands on each side from anterior to



1. **O. parvula** D. & H., dorsal view of mesothorax.
2. **O. fusca** sp. n., dorsal view of mesothorax.
3. **O. minima** sp. n., dorsal view of mesothorax.
4. **O. obesa** sp. n., dorsal view of mesothorax.

posterior margins except most dorsal pair which may be interrupted. Large dark triangular mark on posterior medial part of mesonotum. Metanotum and dorsal abdominal segments variable in color, all dark or only posteriorly dark margined segments. Venter of abdomen dark. Legs brownish.

Structural Characteristics. Antennal formula 1st: 2nd: 3rd: 4th: : 40: 28: 28: 40 in female. Second antennal segment longer than interocular space. Anterior femur longer than mesonotum; tibia three-fifths length of femur; tar us two-thirds length of tibia, first segment one-fourth length of second. Intermediate femur about three-fifths length of tibia; tarsus longer than femur, first segment one and a half times longer than second. Posterior tibia three-fifths length of femur; tarsus two-thirds length of tibia; first segment longer than second. Pronotum: mesonotum: metanotum: : 17 : 45 : 50 in female.

Holotype female, and twenty-two paratypes. Manacapuru, S. A. Amazonas, Brazil, Solimoes River. 3 to 6 - 26. S. M. Klages, and one paratype British Guiana, Supurini Creek, Aug. 1937, S. Harris. All types in the Francis Huntington Snow Entomological Museum, University of Kansas, Lawrence, Kansas.

Notes. **O. fusca** differs from **O. minima** and **O. parvula** by larger size and different color pattern, from **O. obesa** by lack of tuft of hair on medial posterior margin of last dorsal abdominal segment, and color pattern.

Key to Ovatametra

1. Body under 2.5 mm. long 2
1. Body 2.5 mm. long or more 3
2. Mesothorax dark chestnut brown between dark longitudinal bands on dorsum; female with no dark markings on abdomen. .... **O. minima** sp. n.
2. Mesothorax yellow between dark longitudinal bands on dorsum; female with dark markings on venter of abdomen. .... **O. parvula** D. & H.
3. Last dorsal abdominal segment with tuft of dark hairs on median posterior margin; mesonotum with continuous dark median mark from anterior to posterior margins, most dorsal longitudinal dark bands connected transversely on posterior margin .... **O. obesa** sp. n.
3. Last dorsal abdominal segment without tuft of dark hairs on median posterior margin; mesonotum without continuous dark median mark, most dorsal longitudinal dark bands not connected transversely on posterior margin .... **O. fusca** sp. n.

NOTES ON DIPTERA IN SNOW ENTOMOLOGICAL COLLECTION

D. ELMO HARDY, Lawrence, Kansas*

BIBIONIDAE

Bibio stonei n. n. for **Bibio dubius** Bellardi, nec **B. dubius** Germar.

Doctor Alan Stone of the United States National Museum has pointed out to the writer that the name **dubius** is preoccupied in the genus Bibio. **Phthiria dubia** Germar was transferred to Bibio in 1856 by Giebel (Fauna Vorwelt (2) 1, 221). The combination **Bibio dubius** Germar, therefore antedates **B. dubius** Bellardi (Saggio di Ditt. Mess. I, 1859).

PSYCHODIDAE

Telmatoscopus albipunctatus (Will.), 1893, Ent. News 55, 113. The synonomy of **Psychoda snowii** Haseman with **T. albipunctatus** (Will.) has been confirmed by a study of cotypes in the Snow Collection.

Telmatoscopus niger (Banks), 1894, Can. Ent., 26, 331.

The following added synonomy is based upon a study of the cotypes in the Snow Collection.

Pericoma longiplata Haseman, 1907, Trans. Amer. Ent. Soc., 33, 308.

Pericoma scala Haseman, 1907, Trans. Amer. Ent. Soc., 33, 307-308

Psychoda cinerea Banks, 1894, Can. Ent., 26, 331.

Specimens in the Snow Collection determined (probably by Haseman) as **P. minuta** Banks proved to be **P. cinerea** Banks, although they fit the description of **P. minuta** in all details. These may prove to be synonymous.

MYDAIDAE

Opomydas limbatus (Williston) 1886, Trans. Amer. Ent. Soc., 12, 292 (Ectyphus).

The type of this species, in the Snow Collection, was labeled "**Ectyphus luteola** Williston" with the name **limbata** in parentheses in the lower left corner of the label. **E. luteola** appears to have been just a cabinet name.

DOLICHOPODIDAE

Dolichopus procerus Van Duzee and Aldrich, 1920, Proc. U. S. Nat. Mus., Bul. 116, p. 209.

*Contribution from the Department of Entomology, University of Kansas

Examination of the type of **Dolichopus jugalis** Tucker proved it to be a synonym of **D. procerus.** The type of **D. jugalis** was labeled "**Dolichopus transjugalis** Tucker" in the Snow Collection. This again was apparently just a cabinet name.

CYRTIDAE

Pterodontia flavipes Gray, 1832, in Griffith, Animal Kingdom, Ins. XV.

> **Pterodontia flavoscutellata** Steyskal, 1941, Bull. Brook. Ent. Soc., XXXVI, 140. New synonomy based upon a comparison of metatype specimens with typical **flavipes.** The wide range of color variations and sexual differences cover Steyskal's material.

INDEX—VOLUME 15

REPRINT PRICES

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

Pages		1-2	3-4	5-8	9-12	13-16	17-20	21-24	25-28
50	copies	$1.10	$1.40	$3.85	$5.25	$7.45	$ 9.65	$11.85	$14.05
100	copies	1.40	1.65	4.15	5.80	8.00	10.20	12.40	14.60
200	copies	1.65	2.20	4.95	7.15	9.35	11.55	13.75	15.95
100	Add'n'l	0.55	1.10	2.20	3.30	4.40	5.50	6.60	7.70

Tables—for setting up—$1.25 per page extra.

Covers, per 100—$2.50

Fifty copies of reprints are free to the authors provided at least 50 copies are purchased. Reprints should be ordered in lots of 50 or multiples thereof.

Postage or express charges on carriage of reprints are extra

PRICE OF BACK VOLUMES

Volume 1 .... $2.00

Volumes 2 to 7 inclusive 1.00

Volumes 8 to date 1.50

Subscriptions for back volumes or numbers should be sent to Donald A. Wilbur, Entomology Department, Kansas State College, Manhattan, Kansas.

CONTENTS OF THIS NUMBER

JOURNAL OF THE
KANSAS ENTOMOLOGICAL SOCIETY

A quarterly journal published in January, April, July and October devoted to Entomology in the Western Mississippi Basin and the proceedings of the Kansas Entomological Society.

Manuscripts for publication may be sent to any of .ne publication committee.

The Kansas Entomological Society does not make exchanges since the Society does not maintain a library.

Subscription to the Journal must be paid in advance. The subscription rate is so low that second notices are not ordina ''y sent out.

Payment of Canadian or other foreign subscriptio: s and bills must be made by international Postal Money Order or by a draft on a New York bank and payable in U. S. A. dollars.

Subscribers are urged to give us their full cooperation in these matters.

Subscriptions should be sent to Donald A. Wilbur, Entomology Department, Kansas State College, Manhattan, Kansas.

Subscriptions in the U. S. A.,	**$1.50 per year**	**Single Copy**
Canadian or foreign subscriptions,	**1.75 per year**	**60 cents**

Vol. 15, No. 4, October, 1942